

THE MAKING

and vse of the Geometri-
call Instrument, called a

SECTOR.

Whereby many necessarie Geometri-
call conclusions concerning the proportio-
nall description, and diuision of lines, and fi-
gures, the drawing of a plot of ground, the translating of
it from one quantitie to another, and the casting of it vp
Geometrically, the measuring of heights, lengths,
and breadths may be mechanically perfor-
med with great expedition, ease, and
delight to all those, which com-
monly follow the practise of
the Mathematicall Arts,
either in Suruaying
of Land, or o-
therwise.

Written by *Thomas Hood*, Doctor in
Physicke. &c. &c. &c.

The Instrument is made by *Charles Whitwell*,
dwelling without Temple Barre against
S. Clements Church.

L O N D O N

Printed by *John Windet*, and are to solde at the great
North dore of Paules Church by
Samuel Shorter.

THE MAKING

and use of the Geometrical

call instrument, called a

SECTOR.

Whereby many necessary Geometrical

call conclusions concerning the properties

of all description, and division of lines, and of

figures, the drawing of a plot of ground, the translating of

it from one quantity to another, and the casting of it up

Geometrically, the measuring of heights, lengths

and breadths may be mechanically performed.

And with great exactness, ease, and

delight to all who use it.

It is mostly followed by

the Mathematicians, and

either by the Surveyors

of Land, or by the

Architects.

Written by Thomas Hood, Doctor in

Physick, 1652.

The Instrument is made by Charles Whitwell,

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St. Clements Church.

L O N D O N

Printed by John Widdowes, and are to be sold at the great

North door of Pauls Church by

Samuel Sharper.



TO THE RIGHT

Honorable *Charles Blunt* knight, Lord
Montioye, Knight of the most Honourable
order of the Garter, and Captaine of
her Maiesties Forte of Portesmouth.

T. Hood wisheth increase of
honour, and fe-
licitie.

*Ita vita est hominum, quasi cum Ladas tesseris:
Si illud, quod est maxumè opus iactu, non cadit,
Illud, quod cecidit, id arte vt corrigas.*

I May well begin Right Honourable
with those words, which *Micio* in *Te-*
rence vsed to *Demea* concerning a
misdemeanour comitted by his ad-
opted sonne *Æschinus*, who was
therefore contented with his deed,
because at that time it could not be a-
mended. For when I committed this Booke to the presse,
it was not my purpose to dedicate it to your Honour, or
to make it a signe of that duetifull regarde, which I beare
vnto you, both because your person seemed to craue, and
mine intent vrged a better present. But the time hauing
soddainly besides mine expectation wrought a mutuall

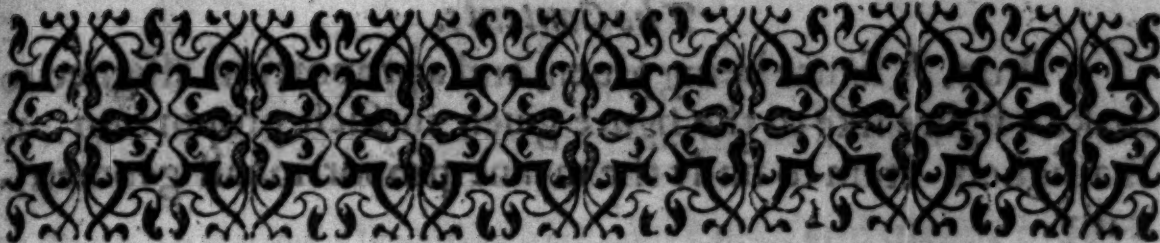
The Epistle.

inclination in vs both, in your honour to fauour, and in
me to bee fauoured, I woulde not omit the oportunitie
thereof, but rather chose by the presentation of this smal
worke to enter your fauour, then to stay vntill a better
were finished. Accept it therefore right honorable, as
it is intended; and let it rest vnder your tuition, and what-
soeuer it is, thinke of it thus, that it proceedeth from him,
that will be ready at all times not onely to pray for,
but to do your Honour what seruice or pleasure
you thinke good to command.

Your Honors most

humble

Th. Hoade.



The Contents of this Booke.



IN the first Chapter these things are handled. The definition, and partes of the Sector which are essentiall, with their severall inscriptions, and the manner how those inscriptions are made.

Item in a Circle giuen to finde Geometrically severall chordes of the saide circle, which may be the sides of regulare figures, namely of an Hexagon, an equilater triangle, an Heptagon, an Enneagon, or figure of 9. sides, a square, an Octogon, a Decagon, a Pentagon.

Item to finde the power of lines geometrically, namely a line whose power shall be to the power of a line giuen as 1. to 2. as 1. to 3. &c.

In the 2. Chapter are set downe the accidentall partes of the Sector, and how they are to be applyed to the essentiall partes.

The 3. Chapter hath generall rules concerning the vse of the Sector.

The 4. Chapter teacheth the vse of the inscriptions made in the fore side of the feete of the Sector, and contayneth these propositions following.

1. Prop. Two numbers being giuen whereof the greatest exceedeth not 120. to finde two lines hauing such proportion one to another, as the numbers giuen haue.

2. Prop. A line being giuen and a proportion assigned to find a line, which shalbe to the line giuen in such proportion as is assigned.

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3. Prop. A figure being giuen, and a proportion assigned to make a figure like to the figure giuen in such proportion, as is assigned. Item to finde the meane proportionall geometrically.

4. Prop. A greater triangle being giuen, and a proportion assigned to finde a lesser triangle like to the triangle giuen in such proportion as is assigned.

5. Prop. A lesser triangle being giuen, and a proportion assigned to make a greater triangle like to the triangle giuen in such proportion as is assigned.

6. Prop. A greater triangulate being giuen, and a proportion assigned to make a lesser like to the triangulate giuen in such proportion as is assigned.

7. Prop. A lesser triangulate being giuen, and a proportion assigned to make a greater like to the triangulate giuen in such proportion as is assigned.

8. Prop. The translating of a plat from one scale to another, namely thus. A figure being giuen, and a proportion assigned, to make a like figure, whose sides shall be to the sides of the figure giuen in such proportion as is assigned.

9. Prop. To diuide a figure giuen in such proportion as is assigned.

The 5. Chap. concerning the vse of the inscriptions made in the nether side, or backside of the feet of the Sector, and containing these propositions following.

10. Prop. A diameter of a circle being giuen to finde any chorde, whose number is inscribed in the feet of the Sector.

11. Prop. Any chorde whose number is inscribed in the feet of the Sector being giuen to find the diameter of that circle, wherein the said chorde may be inscribed.

Item by the Sector to inscribe in a circle giuen, an equilateral triangle, a square, a Pentagon, an Hexagon, an Heptagon, an Octogon, an Enneagon, a Decagon.

Item in a circle giuen to inscribe a figure hauing twise, foure times, or eight times &c, so many sides as any of the foresaide figures haue.

Item.

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Item to find the side of a Quindecagon.

Item to finde the chorde subtending the 30. part of the circle giuen.

Item to diuide a line giuen by extreame, and meane proportion.

Item the lesser extreame being giuen to find the greater, and meane proportionall.

Item the greater extreame being giuen to find the lesser, & the meane proportionall.

Item the meane proportionall being giuen to finde the two extreames.

Item the side of a square being giuen, to finde the 2. sides of an oblonge equall to that square.

Item one, or both sides of an oblonge being giuen to finde the sides of a square equal to the oblonge giuen.

Item one side of an oblonge, & a square being giuen to find the other side of the oblonge equall to the square.

Item two proportionall lines being giuen to find the third.

Item three proportionall lynes being giuen to finde the fourth.

Item vpon a line giuen to make a triangle whose seuerall angles at the base shall be double to the angle remayning.

12. Prop. A line being giuen to finde another line, whose power shall be to the power of the line giuen in any such proportion as is exprest in the feet of the Sector.

Item generally to make any kinde of right lined figures, or circles, which shall haue such proportion one to another as is exprest in the feet of the Sector.

Item two vnequall like figures being giuen, to finde a line, vpon which the figure made like to one of the figures giue shall expresse the difference of the greater figure giuen aboue the lesser.

Item the proportion of one figure made vpon the foot, and of another made on the base of a right angled triangle being knowne to find the proportion of the figure made vpon the other foote to cyther of those figures.

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Item the axletree of a spheare being giuen to find the sides of the 5. ordinate, or regulare bodies to bee inscribed in that spheare.

The 6. Chapter concerning the vse of the feet of the Sector, and the circumferentiall limbe.

Item how to vse the Sector as a squire,

Item howe to vse the Sector as a rectificatorium in making Sunne dials.

Prop. 13. The quantity of angle being assigned how to make an angle according to the quantitie assigned.

Prop. 14. Two numbers or more being giuen, whereof the greatest exceedeth not 150. to find lines hauing such proportion on one to another as the numbers giuen haue.

Prop. 15. Two lines being giuen to find what proportion the one hath to the other.

Item to find what proportion one figure giuen hath to another, and their excesse.

Item Geometrically to cast yppe the content of a platte of ground.

Item to translate a platte from one scale to another.

The 7. Chapter concerning the vse of the essentiall and accidentall partes of the Sector ioyntly together.

Prop. 16. An angle being giuen to find the quantity thereof.

Prop. 17. A point being giuen and the quantity of an angle being assigned to make an angle according to the quantitie assigned.

Item in platting of a peece of ground how to protract the angles by the Sector.

Item an angle being giuen to find the quantity thereof, and what proportion it hath to the whole circumference.

Item to find a right line answerable and equall to an arke of a circle assigned.

Prop. 18. To take the distance eyther of 2. starres one from another, or of a starre from a point assigned in the heauen, and consequently the azimuth, or oriental, and occidental amplitude

of

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of the Sunne or stars.

Prop. 19. To take the height of sunne or star, or anything els seene in the heauen about the horizon.

Item the height of the sunne being giuen to find the houre of the day.

Item to take the angle of the height, depth, breadth, or length assigned.

Prop. 20. A peece of ground being assigned to make the plat thereof.

Prop. 21. Two lines, or numbers being giuen to find the third proportionall.

Prop. 22. Three lines, or numbers being assigned to find the fourth proportionall.

Prop. 23. To make an angle at the center of the index equal to the angle made at the center of the Sector.

Prop. 24. Two angles of a triangle being knowne, and situated at the end of a line knowne to finde the other two sides, & the thirde angle.

Item to finde the breadth, depth, height and length assigned, and the Hypotenusall line of a right angled triangle.

Prop. 25. Two angles of a triangle being knowne, whereof the one is situated at the end of a line knowne, the other opposite to the said line, to finde the third angle, and the two sides vnknowne.

Item the vse of this proposition in seatching out the height, breadth, &c. assigned.

Item a whole heygth, or other dimension being knowne to find the partes thereof.

Prop. 26. One angle of a triangle, and the feet of the sayde angle being knowne to finde the base, and angles vnknowne.

Prop. 27. One angle and two lines being giuen, whereof the one is the foot of the angle giuen, and the other subtended to the said angle, to finde the quantity of the other line, and the 2. angles vnknowne.

Prop. 28. To take a dimension, bee it height, length or breadth at 2. stations.

The Content.

Moreouer there are set down in the margent such Geometrical propositions as serue for the prooofe of all the conclusions deliuered in this booke: These propositions are taken out of Ramus his geometrie translated by my selfe: At the end of many of them you shall find certaine numbers: the former number expresseth the proposition, the latter designeth the booke containing the propositions of Euclid answerable to those which are recited out of Ramus.

THE





THE VSE OF THE Geometricall instrument, called *a Sector.*

Chapter 1.



Sector is a mathematicall instrument consisting of 2. seete, one moueable, an other fixed, making an angle, and of a circumferentall Limbe. The angle which the two seet make, is called an angle of the center, and so it is generally to be vnderstode in the vse of the Sector, and is expressed by the letters, B A C.

The point, wherein the seet of the Sector do concurre, is called the center of the Sector, and is noted by the letter A.

The circumferentall Limbe is noted by the letters D E.

The parts of the Sector are essentiall, or accidentall.

The essentiall partes are those, whereof the Sector taketh his name, and without the which it cannot be called a Sector.

The essentiall parts are right, or crooked.

In both these partes wee are to consider the senerall sides, and their

The vse of the Sector.

their inscriptions.

The sides are 2. The foreside, or upper side: and the backside or nether side, which are easily distinguished one from another by the holding of the instrument.

The instrument being vsed is so to be held, as that the center be vpperward, and next to your bodie, for so the letters and figures inscribed in the instrument do require. Therefore I call that the vpper side, or foreside of the instrument, which is obiect to your sight the moueable foote of the instrument being on your right hand, and the fixed foot on your left hand the angle of the center BAC being next your bodie, as is aforesaid.

The backside, or nether side is the contrari side, namely that, which is from your sight, the instrument being situated as before.

The inscriptions are on both sides, as well of the right partes as of the crooked. And here we are to consider what they are, and how they are inscribed.

The right partes are the 2. feete of the Sector making the angle BAC at A , the center of the Sector.

The breadth of the feet, and their length is at the pleasure of the workman, with this prouiso, that each of them bee conuenient to receiue such inscriptions as are requisite in the vse of the Sector. The feete must bee of one breadth, for so it is more conuenient for vse then other wise: And the limites of the breadth must be parallel. The feet must bee of one length equal one to another, with sharpe points at the ende of them, the which are called the pointes of the Sector and are expressed by the letters BC .

The length of each foote is to bee counted from the center A to the points of the Sector, though the inscriptions extend not so farre expressely.

If a triangle
haue equal
feete the an-
gles at the
base are e-
qual &
contrari-
wise. 5. & 6.
p. 1.

The feete make an Isosceles triangle as well with the circumferentall Limbe annexed to them, as with the plane surface vppon which they are set. Therefore the angles at the base are equall. 10. p. 6, b. of Ram.

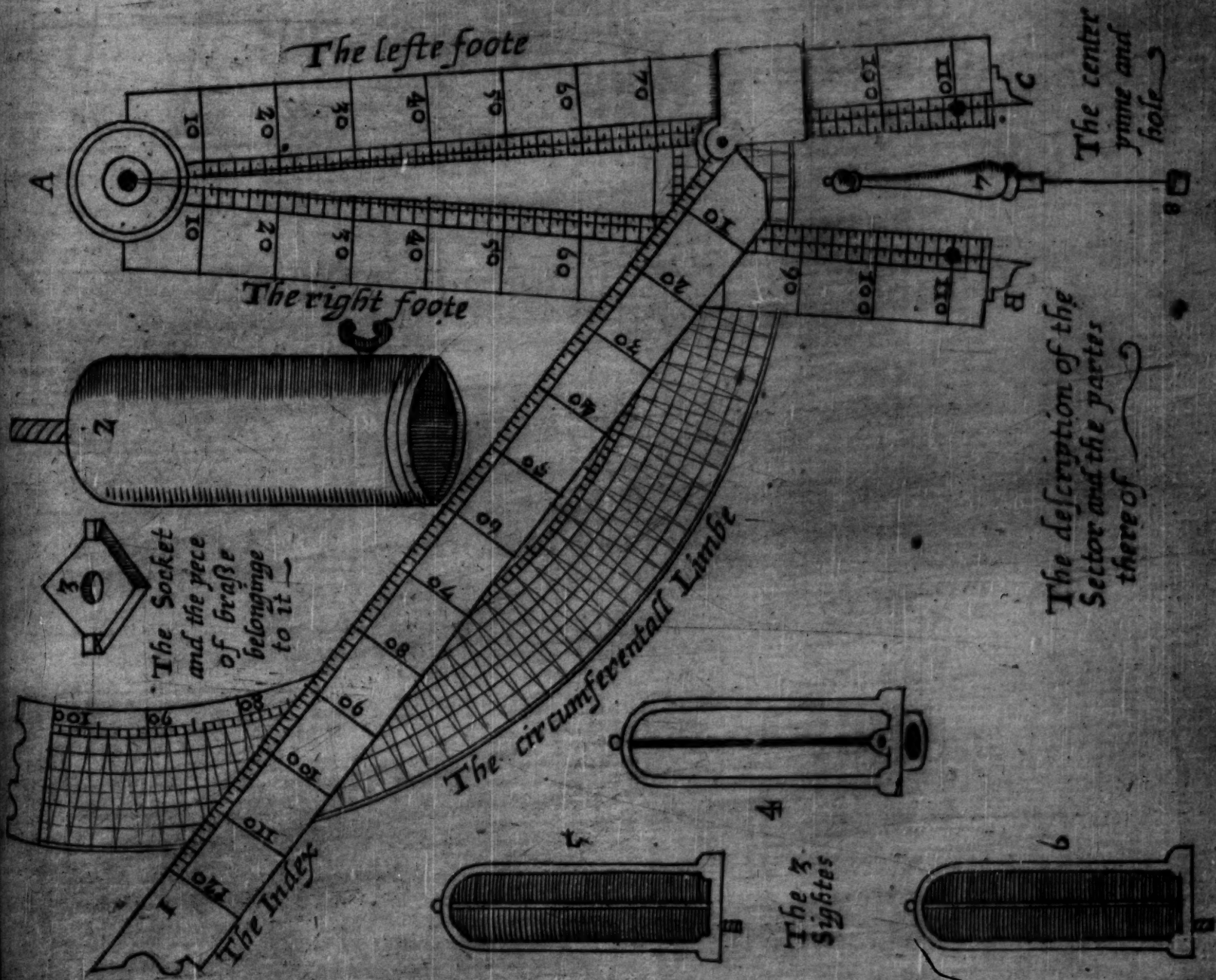
The pointes of the Sector must be carefully looked vnto both in making and keeping of the instrument, because the chiefeest vse thereof dependeth on them.

The vse of the Sector.

2

Of the feet one is called the right, the other the left foot.
 The right foote is that, which is moveable to and fro vppon the
 Limbe as occasion serueth, and is noted with the letters A, B.
 The left foote is that which is fixed to the circumferential limbe,

by the co.



by the numbers assigned to them, as by example
 C designeth

The vse of the Sector.

their inscriptions.

The sides are 2. The foreside, or upper side: and the backside or nether side, which are easily distinguished one from another by the holding of the instrument.

The instrument being used is so to be held, as that the center be upwarde, and next to your bodie, so the letters and figures inscribed in the instrument be read.

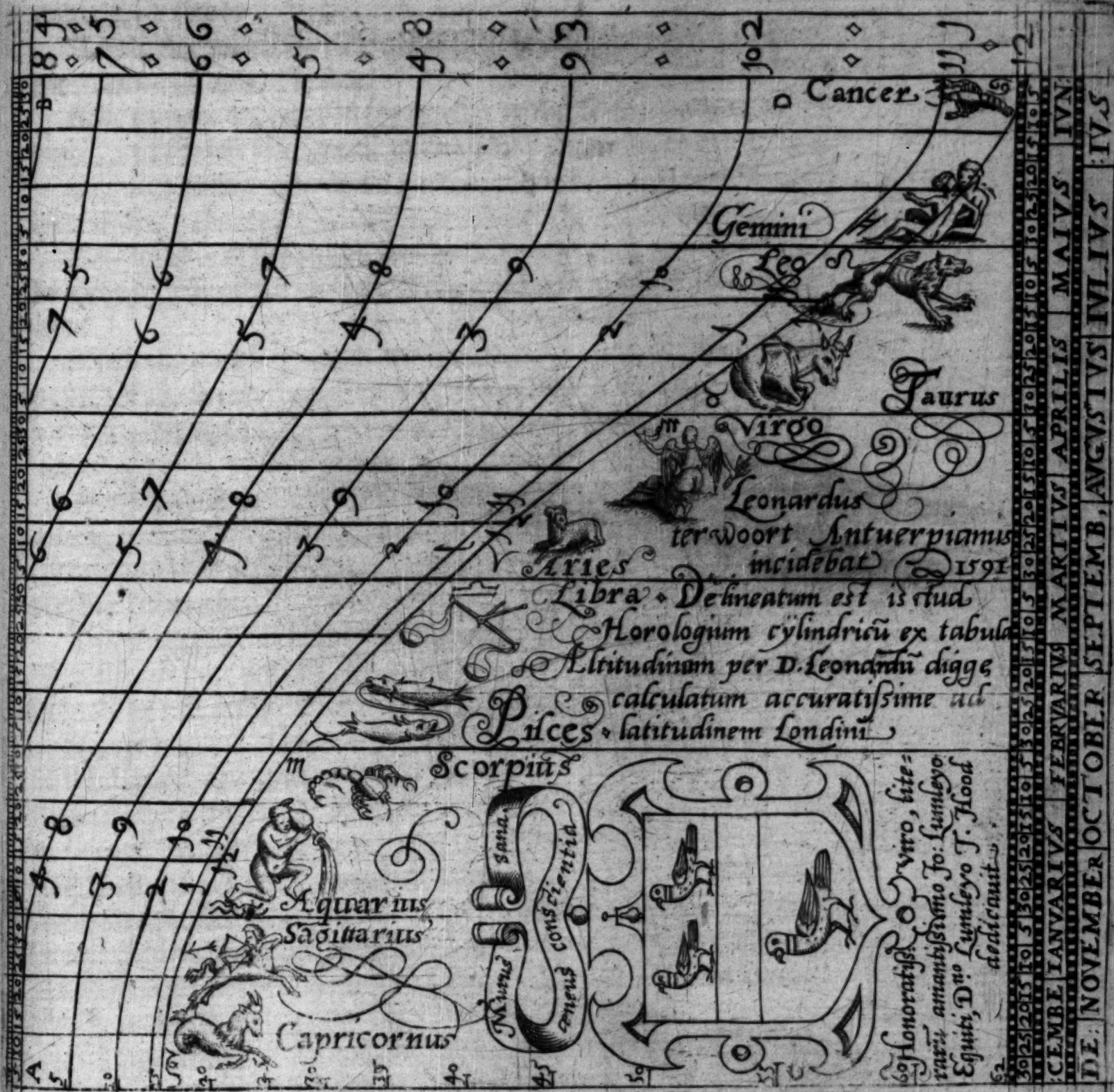
The vse of the Sector.

2

Of the feet one is called the right, the other the left foot.

The right foote is that, which is moveable to and fro vppon the Limbe as occasion serueth, and is noted with the letters A, B.

The left foote is that which is fixed to the circumferential limbe,



by the numbers assigned to them. As for example the number 3.
designeth

The vse of the Sector.

their inscriptions.

The sides are 2. The foreside, or upper side: and the backside or nether side, which are easily distinguished one from another by the holding of the instrument.

Of the feet one is called the right, the other the left foot.

The right foote is that, which is moveable to and fro vppon the Limbe as occasion serueth, and is noted with the letters A, B.

The left foote is that which is fixed to the circumferential limbe, and is expressed by the letters A, C.

The vpper and nether side of the feete is easily knowne by the common notice set downe before.

The thinges inscribed in the foreside of the feete, as well in the right as in the left foot, are all of one kinde, namely, equall partes.

The line diuided into equal partes is that line, which is drawen directly from the center A. to the pointes of the feet B. and C.

The summe of the equall partes is 120. in each foot, which may be more or lesse at the pleasure of the workeman, but these are sufficient.

Their number beginneth at the center A. and endeth last at the points of the Sector, as may appear by the figures adioyned to each 10. part, sauing that the partes nexte to the points are not expressed.

It is needlesse to write how they are inscribed, because every no- uice in Geometrie knoweth both howe to diuide a right line into a certain number of equal parts, and also how to translate them from one line to another.

The inscriptions in the backside of the feete as well of the right as of the left foote are of 2. seuerall kinds in each foote, yet each kinde in each foot mutually answering one an other.

The seuerall inscriptions (for instructions sake) may be diuided into internal, and externall inscriptions.

I call those internall inscriptions whose numbers (namely these 3. 4. 5. 6. 7. 8. 9. 10) are set next the inner side of each foot. Contrari- wise those are externa^l, whose numbers $\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{5}$ $\frac{1}{6}$ $\frac{1}{7}$ $\frac{1}{8}$ are set nexte the outwarde side of the feet. Yet the points from whence the mea- sure of each kind of inscription is to be taken as occasion requireth, are all in one line, namely in the line drawen directly from the cen- ter A. to the pointes of the feet B. and C.

The internall inscriptions are the seuerall chordes of a circle sub- tending such a portion of the whole circumference, as is signified by the numbers adioyned to them. As for example the number 3.

C

designeth

The vse of the Sector.

designeth the choide subtending the thirde parte of a whole circumference. Item the number 4. designeth the choide subtending the fourth part of a whole peripherie, and so forth of the rest, vnto the choide subtending the 10. part of the whole circumference. The length of these seuerall choides are inscribed in the scete of the Sector from the center A. in the lines A. B. and A. C. (which is the line drawen directly from the center to the pointes of the Sector) in this manner.

Drawe a right line G H. equall in length to one of the scete of the intended Sector, diuide it into 2. equall partes in the point I. Let I. be the center and the Radius, or semidiameter I. G. describe a semicircle G N H. The right line I. G. shall be a line subtending the sixte parte of the whole circle, and is the side of an Hexagon, as may be proued by the 6. p. of the 11. b. of Ramus.

Count the line I. G. in the circumference G N H. from G. to K. and from K. to L. and draw the right lines G K. and G L. The right line G L. shall subtend the thirde parte of the circle and is the side of an Equilater triangle, as may be proued by the seconde consectorie of the forenamed proposition.

From I. draw a right line I R. perpendicular to G K. cutting the arke G K. in R. and the line G K. in M. The line I. M. shall be a line subtending the seuenth part of a circle, and is the side of an Heptagon, as may be proued by the last Prop. sauing one of the 1. booke of Car. Bouill.

Diuide the arcke R. K. into thre equall partes in the pointes S. and T, and let S. be the next segment to R. From S. to G. drawe a right line. The line G S. shall subtend the ninth part of the circle, and is the side of an Enneagon, as may be proued by that proportionall rule of the Mathematicians, which sayth, that If a quarter of a circle be diuided into a certaine number of equall partes, foure of those partes shall diuide the whole circle, as the quarter was diuided: For as one part is to one quarter, so are foure partes to foure quarters, which is the whole circle.

From I. rayse a line I N. perpendicular to G H. cutting the circumference in N. The right line drawen from H to N. shall subtend the fourth part of the circle and is the side of a Square as may be proued by the 2. p. of the 18. b. of Ramus.

From

The Radius of a circle is the side of an Hexagon inscribed. 15. p. 4

If right lines drawn from som one angle of an Hexagon inscribed, be ioyned to ech third angle on both sides they wil inscribe an equilater triangle in the circle giuen.

If the diameters of a circle bee cut one by another at right angles, the line subtended to the right angle shall be the side of a square 6. p. 4

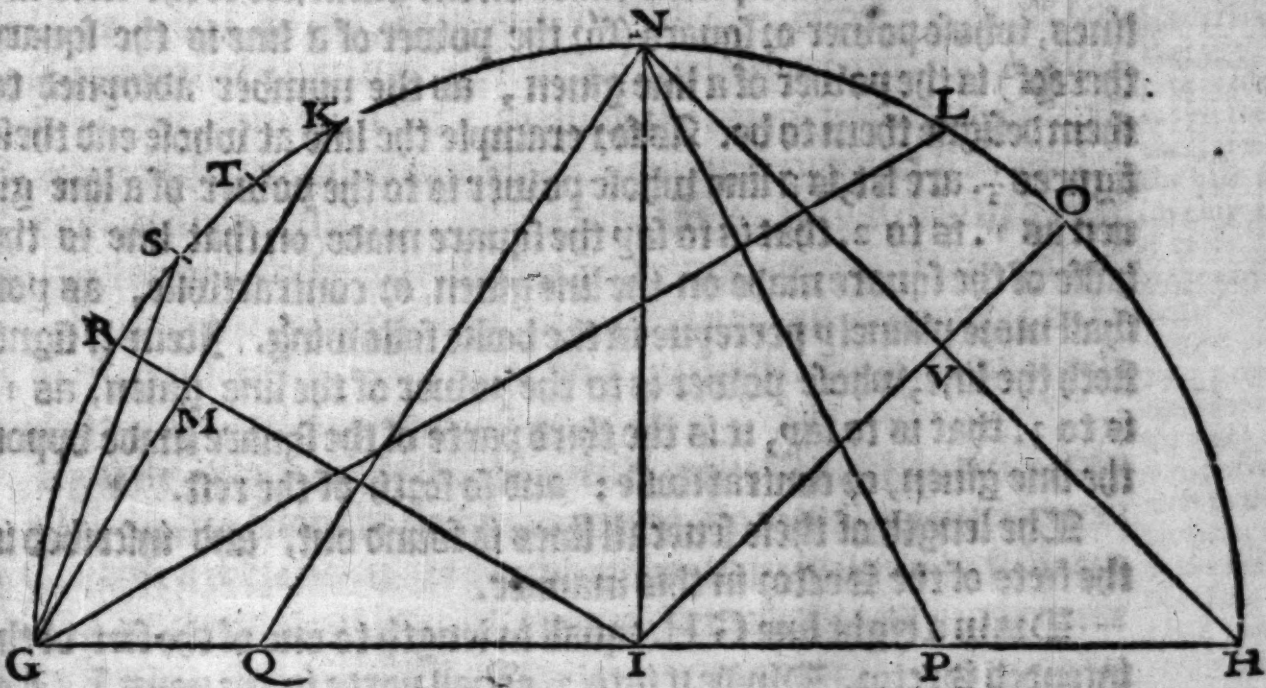
The use of the Sector.

From I. draw a right line I O. perpendicular to H N. cutting the circumference in O. The right line drawn from H. to O. shall subtend the eight part of a circle, and is the side of an Octagon, as may be proved out of the 9. p. of the 16. b. of Ram.

Divide the Semidiameter I H. into two equall partes in the pointe P. and drawe the right line P. N. Count the line P N. in the line G H. from P. to Q. The line I Q. shall bee a chorde subtending the 10. parte of a circle, and is the side of a Decagon, as may be proved by the ^a 3. p. of the 14. b. and the ^c 8. p. of the 18. b. of Ramus.

From Q. to N. drawe a right line which shall subtende the fiftte parte of the circle, and is the side of a Pentagon, as may bee pꝛoued by the ^d9. p. of the 18. b. of Ramus.

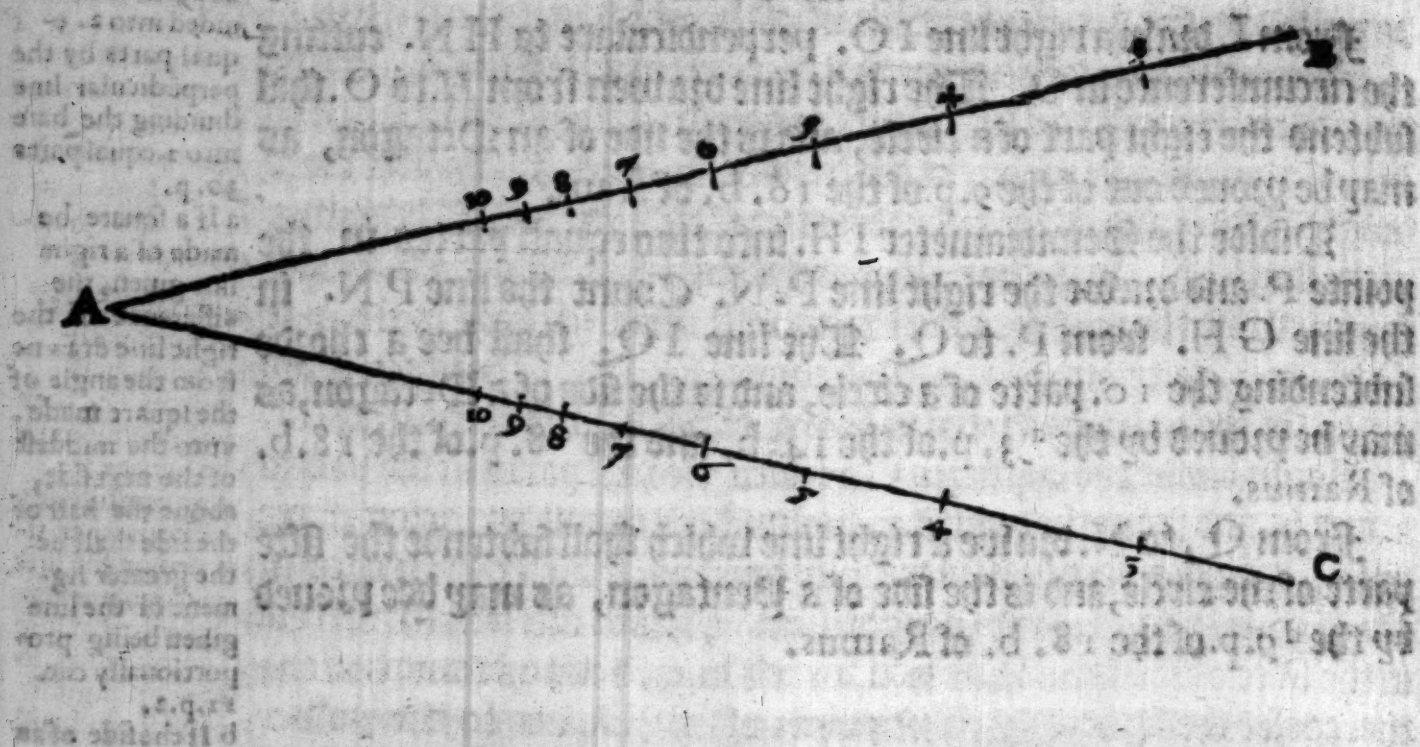
The circumference of a section is di-
 uided into 2. equal parts by the
 perpendicular line
 dividing the base
 into 2. equal parts
 30. p. 5
 a If a square be
 made of a right
 line giuen, the
 difference of the
 right line drawne
 from the angle of
 the square made
 vnto the middest
 of the next side,
 about the half of
 the side shall be
 the greater fig-
 ment of the line
 giuen being pro-
 portionally cut.
 11. p. 2.
 b If the side of an



Count the lines G L. H N. Q N. G K. or I G. I M. H O. G S. I Q. severally in the face of the Sector from the center A. in the lines A B. and A C. and at the end of the line set the numbers according as the portion of the circumference subtended by each severall shall advise you, so shall you inscribe in the face of the Sector the chordes required.

Hexagon bee cut proportionally the greater figment shall be the side of a Decagō. c If a right line be in power correspondent to the sides of an Hexagon, & a Decagō, it is the side of a Pétagō. 10, p. 13.

The vse of the Sector.



The externall inscriptions made on the backside of the feete are lines, whose power or square (for the power of a line is the square thereof) is the power of a line given, as the number adioyned to them designe them to be. As for example the line at whose end these figures $\frac{1}{2}$. are set, is a line whose power is to the power of a line given as 1. is to 2. that is to say the square made on that line is the halfe of the square made on the line given, or contrariwise, as you shall more plainly perceyue in the booke following. Item $\frac{1}{3}$. signifieth the line, whose power is to the power of the line given, as 1. is to 3. that is to say, it is the third parte of the square made vppon the line given, or contrariwise: and so forth of the rest.

The length of these severall lines is found out, and inscribed in the feete of the Sector in this manner.

Draw a right line G H. equall in length to one of the feet of the intended Sector. Divide it into 2. equall parts in the point I. Let I. be the center, and the radius, or semidiameter, I G. Describe a semicircle G H N. Count the length of the line I G. on the backside of the feete of the Sector from the center A. in the lines B A. and A C. and where it endeth make a marke setting by it these figures in this manner $\frac{1}{4}$. The power of the line I G. is to the power of the line G H. as 1. is to 4. and contrariwise the power of the line G H. is to the power of the line I G. as 4. is to 1. as may be

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be proued by the 7. p. of the 12. b. of Ramus.

Agayne from I. rayse a line I N. perpendicular to G H. cutting the circumference G H N. in N. and draw a right line from G. to N. Count the line G N. in the feet of the Sector, as you were taught before, and at the end thereof set these figures $\frac{1}{2}$. The power of the line G N. is to the power of the line G H. as 1. is to 2. and contrariwise the power of the line G H. is to the power of the line G N. as 2. is to one, as may be proued by the 1. conf. of the 15. p. of the 4. b. and by the 2. conf. of the 4. p. of the 8. b. of Ra.

Again diuide the diameter G H. into 3. equal parts in the points a. and b. and from the point a. making the equall partition next vnto G. rayse a perpendicular a P. touching the circumference in P. From P. to G. draw a right line. Count the length thereof in the feet of the Sector, as you were taught before, and at the end thereof set the figures $\frac{1}{3}$. The power of G P. shalbe to the power of G H. as 1. to 3. and the power of G H. shall be to the power of G P. as 3. to 1. as may be proued by the 6. p. of the 12. b. of Ra.

Againe, diuide the line G H. into 5. equall partes in the pointes c. d. e f. and from the point c. making the equall partition next to G. rayse a perpendicular touching the circumference in R. From G. to R. draw a right line. Count the length of G R. in the feet of the Sector, and at the ende thereof set the numbers $\frac{1}{5}$. The power of G R. is to the power of G H. as 1. is to 5. and the power of G H. is to the power of G R. as 5. to 1. as may be proued by the 6. p. of the 12. b. of Ramus.

Agayne, diuide the line G H. into 6. equall partes in the pointes g. a l. b h. and from the point g. making the equall partition next to G. rayse a perpendicular touching the circumference in S. From G. to S. draw a right line. Count the length thereof in the feet of the Sector, and at the end thereof set the numbers $\frac{1}{6}$. The power of G S. is to the power of G H. as 1. to 6. and contrariwise as may be proued by the 1. conf. of the 15. p. of the 4. b. and by the 2. conf. of the 4. p. of the 8. b. of Ramus.

Agayne, diuide the lyne G H. into 7. equall partes, and let G K. be a seventh part thereof. From K. rayse a perpendicular touching the circumference in T. From G. to T. draw a right line.

4 a If a right line be cut into how many parts soever it is in power the multiplex of the segment, the square of the number of the section being denominator thereof.

b If right lines be continually proportionall more by one then the dimensions of the figures are, which are like, & in like manner situated on the first & second line, as the first right line is vnto the last, so is the first figure to the second: and contrariwise.

c In a right angled triangle eyther of the feet is proportionall between the base, & the segment of the base next adioyning to it.

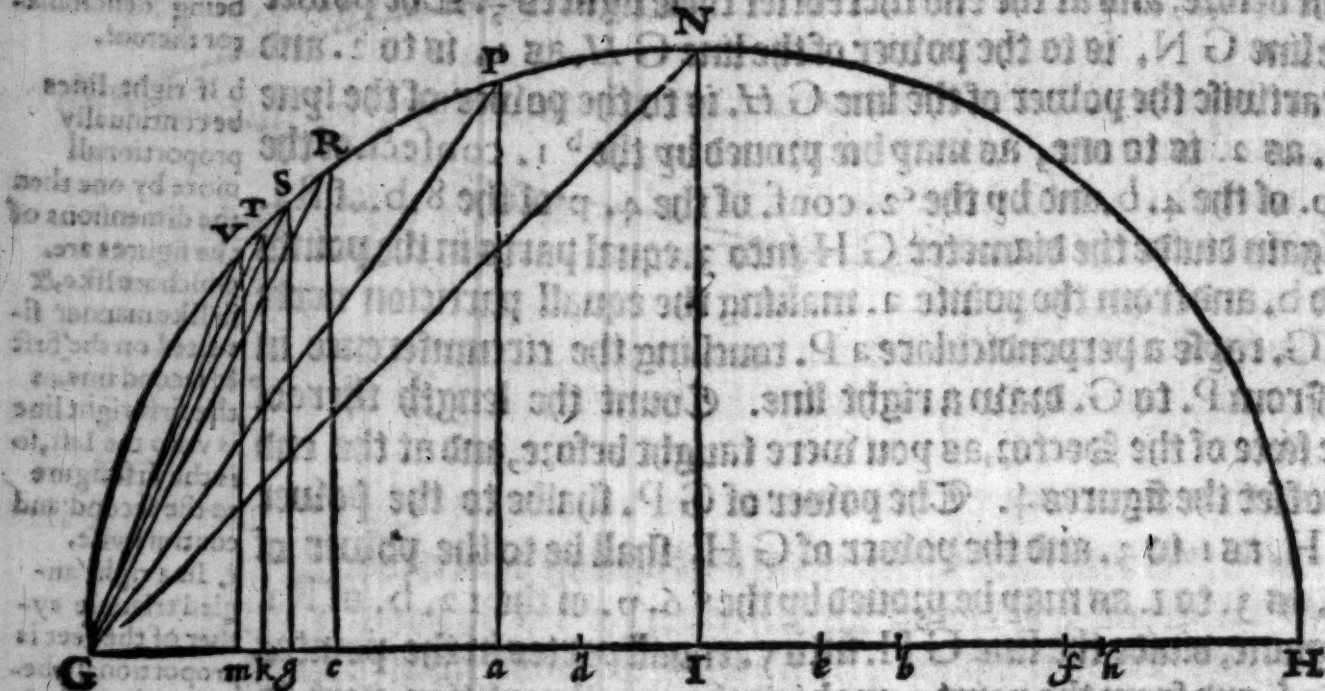
d If the base of a right angled triangle be cut in double proportion by a perpendicular comming from the right angle it is in power sesquialter to the greater foot, & treble to the lesser.

But if the base be cut in quadruple proportion it is sesquiquarta to the greater side, & quintuple to the lesser. 13. 14. 15. p. 13.

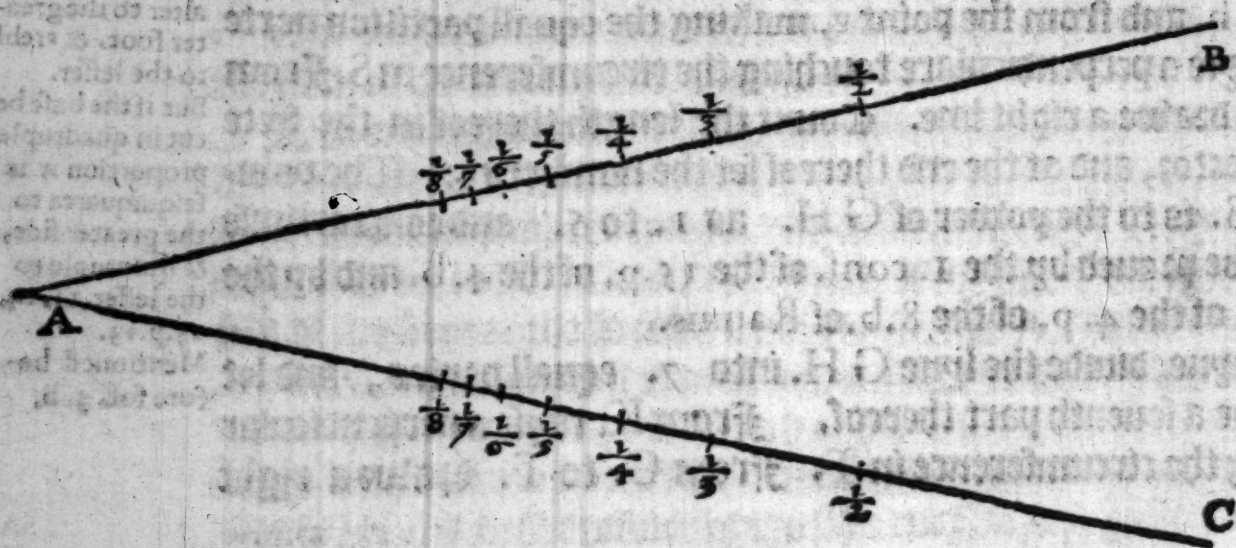
Mentioned before fol. 3. b.

The vse of the Sector.

Count the line GT in the scale of the Sector, and at the ende thereof set the numbers $\frac{1}{2}$. The power of GT is to the power of GH as 1 to 7 , and contrariwise as may be proued by the Propositions last mentioned.



Last of all diuide the line GH into 8. equal parts, and let Gm be an eyght part thereof. From m . raise a perpendicular touching the circumference in V . From G . to V . draw a right line, count the line GV in the scale of the Sector, and at the ende thereof set the numbers $\frac{1}{2}$. The power of GV is to the power of GH as 1 . is to 8 , and contrariwise the power of GH is to the power of GV as 8 to 1 . as may be proued by the propositions last mentioned.



Thus

Thus much concerning the right essentiall parts of the Sector, the sides, inscriptions, and manner of their inscriptions.

The crooked essentiall parte of the Sector is the circumferentall Limbe annexed to the feet.

The breadth of the Limbe is at the discretion of the workman.

The limites of the breadth are parallels one to another, for so it is most convenient.

The length of the Limbe is also at the pleasure of the workman, so it be lesser then a semicircle, for beyond that length the feet cannot be stretched.

The severall sides of the Limbe are distinguished by the general rule sette downe before concerning the severall sides of the Sector.

The thinges inscribed in the foreside, or upper side of the Limbe next to the center of the Sector, are certaine degrees of a whole circle divided into 360. parts.

The summe of the degrees inscribed are 100. they may be more, if you please, but these are thought sufficient for common practise.

The degrees beginne at the innermost side of the left foot: therefore when we are to vse any of the degrees of the Limbe, wee are to regard the inner side of each foot, and the point of the intersection, which the inner side of the right foot maketh in the Limbe, for that limiteth the number of the degrees eyther giuen, or sought for.

The number of the degrees is expessed from 10. to 10. in this manner, 10. 20. 30. and so to 100.

It is needlesse to write how these degrees are inscribed: because it is euery fresh mans worke in Geometrie to learne to make a circle, to diuide it into degrees, and to translate them from one circle to another.

Betwene the arcke containning the degrees, and the outtermost side of the Limbe there are 6. other arches inscribed, crossed with Isosceles triangles whose base is the length of two degrees. Their vse is to subdiuide each degree of the Limbe into minutes, from 10. to 10.

On the backside of the Limbe are three severall scales inscribed, containning severall parts of an inch diuided three severall waies.

The vse of the Sector.

The number of the inches severally divided are 15. as you may perceiue by the right lines drawn from one side of the Limbe to the other.

The partes of ech scale in the limbe are unequal, but make equal segments in a right line.

The scales beginne at that right line in the lefte foote, which is drawne from the center of the Sector directly to the point thereof. Therefore when wee measure any thing by any of the Scales, wee are to take the measure with the points of the seete, but the number of the measure is limited by the uttermost side of the right foot.

The innermost scale of inches nexte to the Center of the Sector, containeth 6. parts in an inch, and ech part is subdivided into halles: their number is expressed from 6. to 6. in this manner, 6. 12. 18 &c. to 90.

The middlemost scale hath 8. partes in an inch, and ech part is divided into halles. Their number is expressed from 8. to 8. in this manner, 8. 16. 24. &c. to 120.

The uttermost scale haeth 10. partes in an inch, and ech part is subdivided into halles. Their number is expressed from 10. to 10. in this manner, 10. 20. 30. 40. 50. &c. to 150.

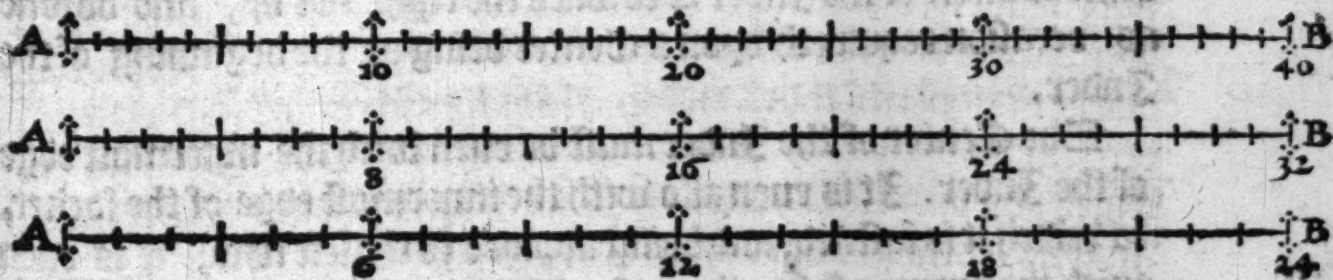
The severall Scales are inscribed in the Limb after this manner: First in the Limbe inscribe thzee severall arches in a reasonable distance one from another, fit & convenient to receyue the diuisions of the scales. Secondly, draw an infinite right line *A B*. and from the point 4. in the line *A B*. count 15. inches: (you may count more if you please, but in the instrument commonly there are no more inscribed) Set the point of the left foote in the point *A*. which is the beginning of the first inch, and stretch the point of the right foote to the beginning of the second inch. Then by the innermost side of the saide foote draw a right line all ouer the breadth of the Limbe. By that line at the innermost arke set 6. at the middlemost arke set 8. at the uttermost arke set 10. according to the number of the partes, into which you purpose to divide euery severall inch in each severall scale. Agayne, set the point of the left foote in the point *A*. and stretch the point of the right foote to the beginning of the thirde inch. Draw a right line close by the innermost side of the same foote all ouer the breadth

The vse of the Sector.

6

the breadth of the Limbe. By that line at the innermost arke set 12. at the middlemost arke set 16. at the uttermost arke set 20. Do this as oftē as ther are inches remayning, keeping stil the point of the left foote in the point A. and stretching the point of the right foote to the beginning of each inch, as they follow successively in order, so shal you in the Limbe inscribe the severall whole inches. The parts of $\frac{1}{2}$ inches in each severall scale are inscribed by the same art, whereby the whole inches are inscribed: saving that as there are 3. severall divisions of the inches, so there must be a threefold work to inferre the severall parts. First therefore the severall inches in the line A B. must be divided into 6. equall partes, and each parte must be subdivided into halves. Then the point of the left foote being set in the point A. the point of the right foot must successively be remoued from one first part to another, and right lines must be drawne at each severall motion of the foote close by the inner side of it, dividing the innermost arke allotted to the scale of 6. partes in an inch into convenient partitions. Secondly the inches in the line A. B. must be severally divided into 8. equall partes, and each part into halves. And as the other were in the uttermost arke, so must these be inscribed in the middlemost arke ordayned for the scale of 8. partes in an inch. Last of all the severall inches in the line A, B must be divided into 10. equall partes, and each parte into halves. And as the other partes were inscribed in the other arkes, so must these partes be inscribed in the uttermost arke of the Limbe appointed for the scale of 10. partes in an inch.

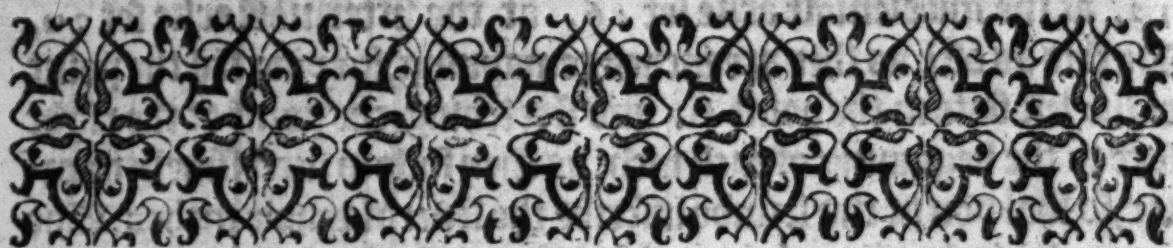
Thus much concerning the essentiall partes of the Sector, their severall sides, inscriptions, and manners of inscriptions.



D

c. Chap.

The vse of the Sector.



2. Chap. Concerning the accidentall partes of the Sector.



The Accidentall partes added in respect of amplifying the vse of the Sector are 8. The first is an hypotenusal Index. The breadth of the Index is answerable to the breadth of eyther of the feete of the Sector. The length of the Index is also correspondent to the length of the feete, it may bee longer but that is sufficient for common practise.

Of the accidentall partes the Index onely hath his inscriptions, the other hath none. The upper side of the Index is inscribed, the nether side is not inscribed. The inscriptions are 120. equall partes answerable both in number and length to those of the feete: therefore it is needlesse to write howe they are inscribed.

To the beginning of the Index there is a socket made fast, by meanes whereof the Index admitteth a double motion. The one motion is to and fro vpon the left foote from the point of it towarde the center of the Sector, and contrariwise as occasion serueth. The other motion of the Index is toward the right foot by, and downe as occasion requireth vpon a Center being at the beginning of the Index.

The Center of the Index must be even with the innermost edge of the Index. It is even also with the innermost edge of the socket, to which it is fastned, and being applyed to the left foote, it is even with the innermost side thereof. Whereupon it commeth to passe, that the innermost side of the Index making an angle with the innermost

innermost side of the left foote the verticall point of the angle is in the center of the Index, and contrariwise the center of the Index is the verticall point of the angle made. This angle in the treatise following is called the angle of the Index. Item for so much as the edge of the Index, and the edge of the socket concurre both in one center: therefore whensoever it shall be required in any proposition ensuing to set the Index vpon such, or such a point of the left foote, the meaning is, that the innermost edge of the socket should be applied to the saide point, and the place of the Index is knowne by the place of the socket.

The edge of the socket nexte to the center of the Index must make a right angle with the innermost side of the left foote.

The Index must be so put on vpon the left foote, that his center may bee next to the center of the Sector: and the edge of the Index receyuing the inscriptions must bee next to the innermost edge both of the same foote, and of the right foote also.

The second accidentall parte is a brazen socket with a screw pin at the top, and another small pinne beside it. The sockette is to be applyed to the center of the Sector so, that the screw may go through it, and the small pinne may fall into the little hole beside the center on the backside of the foote.

The third is a square peece of brasle with a screw hole in it, which is to be applyed to the screw pinne before named, and to be wound down strongly, that by that means y^e Sector may be kept fast to the socket.


The fourth, fift & sixt thing belonging to the Sector are 3. sights.

The sights must stand on the vpper side of the Sector.

Of the 3. sights one must stand at the center of the Sector, the other at the endes of the feet. That sight which hath the screw hole in the bottom must stand at the Center. It is to bee applyed to the screw of the socket, and to be turned to and fro vpon it, one while toward the edge of the right foot, another while toward the edge of the left foot as occasion serueth.

The sights which must stand at the endes of the feet haue a wyer in the middelt and a screw pin in the bottome. These sights must be so applyed to their peculiar foote, as that the wyer may stand directly ouer the edge of that foot to which it is applyed. The sight which

The vse of the Sector.

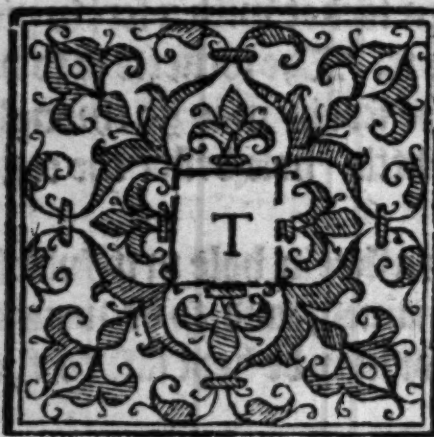
is to be applied to the skrew hole at the end of the right foot is distinguished from the sight belonging to the left foot by this marke  made in the bottome thereof.

The seventh thing accidentall to the Sector is a center hole, which is a round peece of brasse made fit to that great hole, which is at the top of the Sector. In this peece of brasse is a small hole representing and supplying more precisely the center of the Sector.

The eight thing is a Center pinne made fit vnto the center hole before said, which is necessary in performing many conclusions following.

Thus much concerning the parts of the Sector, now followeth the vse thereof.

Chap. 3. Concerning the vse of the Sector.



The vse of the Sector is eyther in the simple partes, or in the partes ioyned and vnited together.

The vse of the Sector in the simple parts is, when the parts of one kind onely are vsed without the rest to effecte any conclusion required.

This vse is to be respected in the fete onely (for the other partes are not for any singular vse without the fete) and that both on the foreside, and backside thereof.

The rules concerning the vse of y fete, are general, or particular.

The generall rules are those, which belong generally as well to the foreside, as to the backside of the fete in this manner.

1. The fete may be vsed in steede of a payze of compasses. 2. The fete may be vsed in steede of a rular. The fete therefore are of singular vse in all Geometricall demonstrations. But it is not my purpose in this booke to meddle with any farther vse of the sector then that, which dependeth vpon the inscriptions made in the seuerall partes thereof, and may conveniently be inferred out of the.

3. What distance soeuer is to be taken from foot to foot without regard

regarde had to the circumferentall Limbe it is to bee taken from some point in the line A B. to some point in the line A C. which are the lines as well in the upper, as in the nether side of the secte, drawn from the center of the sector directly to the points of the feet.

4. In working any conclusion belonging to the Sector, if it be required that a line should be given: the line given must bee longer then the distance betwene the pointes of the secte, for otherwise it cannot be measured or diuided by the points as occasion serueth.

5. Whensoever there is a longer line given, and a shorter sought for, the pointes of the Sector must be set in the endes of the line given, and the shorter line must be taken in the secte in some place, or other about the points as it falleth out.

6. Whensoever there is a shorter line given, and a longer sought for, the shorter line given must be counted between the feet in some one place or other about the points as occasion serueth, and the longer line sought for is the line contained between the points of the feet.

The particular rules concerning the vse of the feet are those which belong to the particular sides, eyther the foreside, or the backside. But of the foreside first, and then of the backside.

Chap. 4. Concerning the vse of the inscriptions

made in the fore side of the secte

of the Sector.



The vse of the inscriptions made in the foreside of the feet concerneth especially the proportion of lines, and secondarily the proportion of figures.

In searching for eyther of these proportions you shall find these thinges to fall out, that eyther the numbers expressing the proportion are given onely, and the correspondent proportionall lines, or figures are sought for, or else with the proportionall numbers there is a line, or figure given, and the rest of the correspondent proportionall lines or figures are sought.

The vse of the Sector.

Item if a line or figure be given it is greater then the line, or figure sought for: or els the line or figure given is lesser then the line, or figure sought. These and such like cases are to bee respected, for from hence ariseth that multiplicitie of propositions following.

Proposition 1.

Two numbers being given, whereof the greatest exceedeth not 120. to finde 2. lines having such proportion one to another, as the numbers given have.



Because the instrument wherewith the proportionall lines are sought for is Geometrical, and Geometrie medleth not with irrationalities no farther forth, then to know or proue that they are so: therefore first I wold haue you to know, y the numbers given must be rationall numbers, that is to say whole numbers, and not mist numbers or fractions. Secondly for so much as the equal partitions inscribed in the feet are no more then 120. therefore I thought good to limite the quantitie of the numbers given. I knowe that by making suppositions wee may apply those partes inscribed in the feet vnto greater numbers, as for example, by doubling them we may suppose them to bee 240. by quadrupling them we may take them for 480. but it is not my purpose to wrest every thing to the uttermost, and therefore I will keepe my selfe within the boundes of the inscriptions, making such vse of them, as may conveniently be made, and will follow of it one accorde without enforcing. To come then to the handling of this proposition, you must note whether any one of the two numbers given bee greater then

If neither of the two numbers given bee greater then 12. to yne vnto each of them on the right hand a cypher, and seeke them out in the feet of the Sector, opening the feet as you thinke convenient.

The

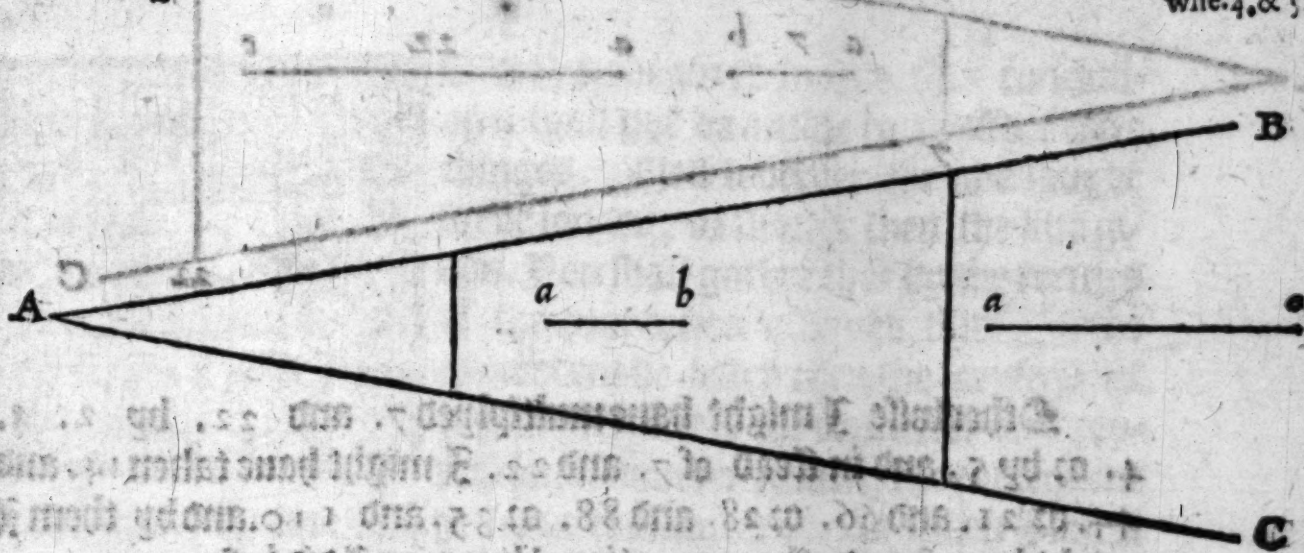
The vse of the Sector.

9

The distance from number to number taken in each foote shall giue the proportionall lines required. An example will make it playne.

Suppose the numbers giuen to bee 4. and 9. It is required to finde two lines hauing such proportion one to another as the numbers giuen haue: Each of the numbers giuen are not greater then 12. therefore I ioyne a cypher to them, and make 40. and 90. I seeke these numbers out in the foete of the Sector, and open the foete as seemeth conuenient. With the compasses I take the distance betwene 40. and 40. also betwene 90. and 90. in each foete, and laydowne those distances in the lines *ab.* and *ac.* I say that the lines *ab.* and *ac.* haue such proportion one to another as 4. and 9. haue, as may be proued by the 8. proposition of the 6. b. and the 9. p. of the 7. b. of Ramus in this demonstration following.

a If a right line in a triangle be parallel to the base, it cutteth the feet proportionally, and contrariwise. 2.p. 6.
b If 2. triangles be equiangle, they are proportional in their feet: & contrariwise. 4. & 5.p. 6.

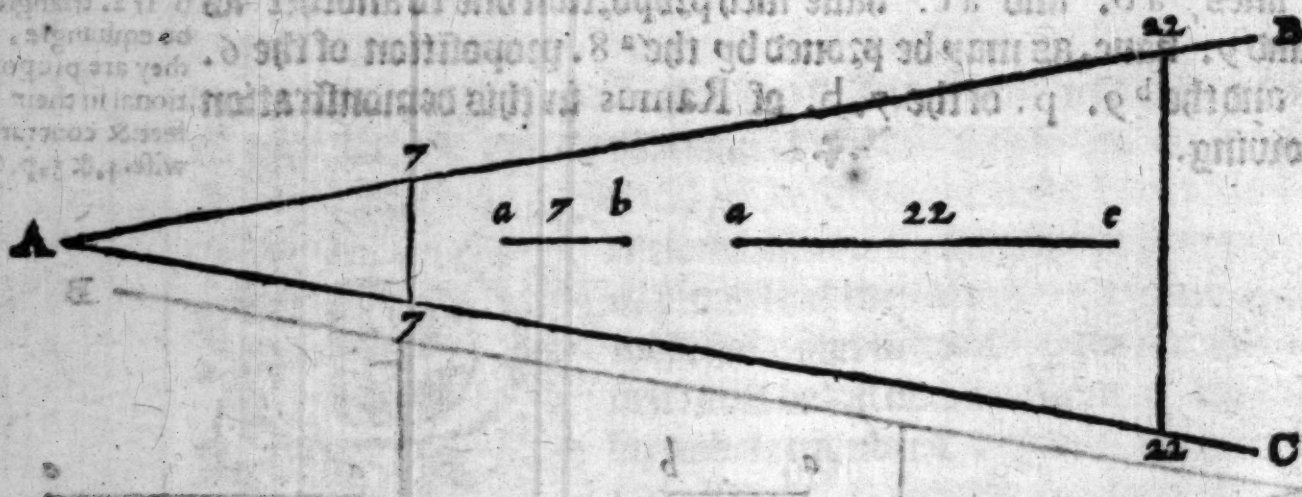


If epyther of the two rational numbers giuen by greater then 12. then ioyne not the cypher vnto them on the right hand, as you did before: but seeke out the numbers giuen in the foete of the Sector, or multiply them by 2. 3. 4. or 5. &c. and seeke the productes out in the foete of the Sector, and then worke as you were taught before, so shall you finde two lines hauing such proportion one to another as the numbers giuen haue. By example the thing will be plaine.

It is a receyued opinion, that the diameter of a circle is to the circumference as 7. is to 22. I desire to finde two lines hauing that proportion

The vse of the Sector.

proportion one to another. Here the last of the two numbers given is greater then 12. therefore I ioyne not the cypher vnto them, but seeke out 7. and 22. in each foote of the Sector, and open the feet as seemeth convenient: with the compasses I take the distance betwene 7. and 7. also betwene 22. and 22. in each foote, and lay downe the distances taken in the lines a b. and a c. I say that the lines a b. and a c. haue such proportion one to another as 7. to 22. as may bee proued by the foze mentioned propositions in this demonstration following.



Otherwise I might haue multiplyed 7. and 22. by 2. 3. 4. or by 5. and in stead of 7. and 22. I might haue taken 14. and 44. or 21. and 66. or 28. and 88. or 35. and 110. and by them I might haue founde the proportional lines, as I did before.

If anie man aske me, why I ioyne him to adde the cyphers to the numbers given, as in the first example, or why I will him, if he thinke it good, to multiplie the numbers given, as in this example, I answer: that the numbers given may be so smal, that the proportionall lines found out, being also little, as the numbers are, will not conveniently serue my purpose, therefore by multiplying them by 10. (so to set a cypher on the right hande of any number is to multiply that number by 10.) or otherwise by 2. 3. 4. or 5. I augment the greatnesse of the numbers retapning still the same proportion (so if a number multiply any numbers, the productes haue the same

same proportion with the numbers multiplied) and consequently I find out greater proportionall lines fitter for my vse then the lesser lines.

Here note that if there be more then 2. rational numbers giuen, the lines answerable to the numbers giuen are founde out in the same manner, and therefore it is needlesse to amplifie this proposition with any longer discourse.

Proposition 2.

A line being giuen, and a proportion assigned to find a line, which shall bee to the line giuen in such proportion as is assigned.



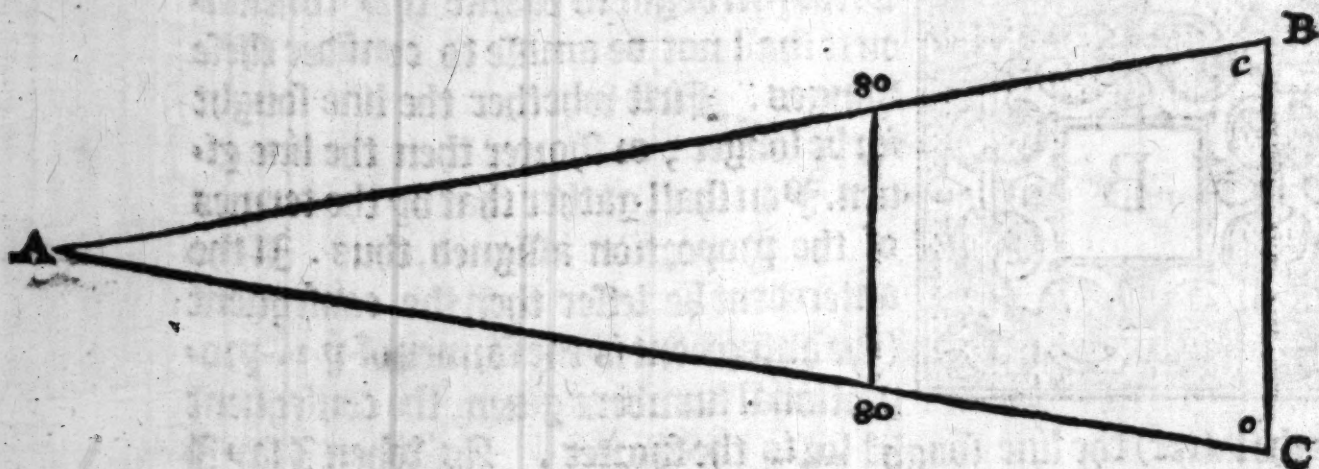
Before you begin to worke this conclusion it shall not be amisse to consider these thinges. First whether the line sought for be longer, or shorter then the line giuen. You shall gather that by the termes of the proportion assigned, thus. If the antecedent be lesser then the consequent (the antecedent is the former of $\frac{2}{3}$. proportional numbers giuen, the consequent is the latter) the line sought for is the shorter. As when I say I giue a line ou , and desire to finde a line which shall be to the line giuen as 2. is to 3. Here 2. the antecedent is lesser then 3. the consequent, therefore the line sought for is lesser then the line giuen: If the antecedent be greater then the consequent, the line sought for is greater then the line giuen. In this case the line giuen must be continued out in length, and the line found out must bee counted from the beginning of the line giuen, to a point at all adventures falling out in the line continued.

Secondly, I must seeke out a number (if it may be found) which shall be to 120. as the lesser number giuen is to the greater. That number is founde out thus: Multiply 120. by the lesser number

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number giuen diuide the product by the greater, the quotient shalbe to 120. as the lesser number giuen is to the greater. This quotient must alwayes be sought for in the scete of the Sector, and it affordeth eyther the line giuen, or the line sought for. Examples wil make the former wordes very plaine. Let the line giuen be c o. and let the proportion assigned be as 2. is to 3. I desire to find a line which shalbe to c o. in such proportion is 2. as to 3. Here by the proportionall numbers I know, that the line sought for is lesser then the line giuen. Secondly multiplying 120 by 2. and diuiding the product by 3. I find 80. in the quotient, which is to 120. as 2. is to 3. I seeke out the number in the scete of the Sector, and set the points of the Sector in the termes of the line giuen c o. Then with the compasses I take the distance from 80. to 80. in each scote, that distance is the length of the line sought for: as may be proued by the^a 8 p. of the 6. b. and the 9. p. of the 7. b. of Ramus in this demonstration following.

^a Mentioned before pag. 9. 2.

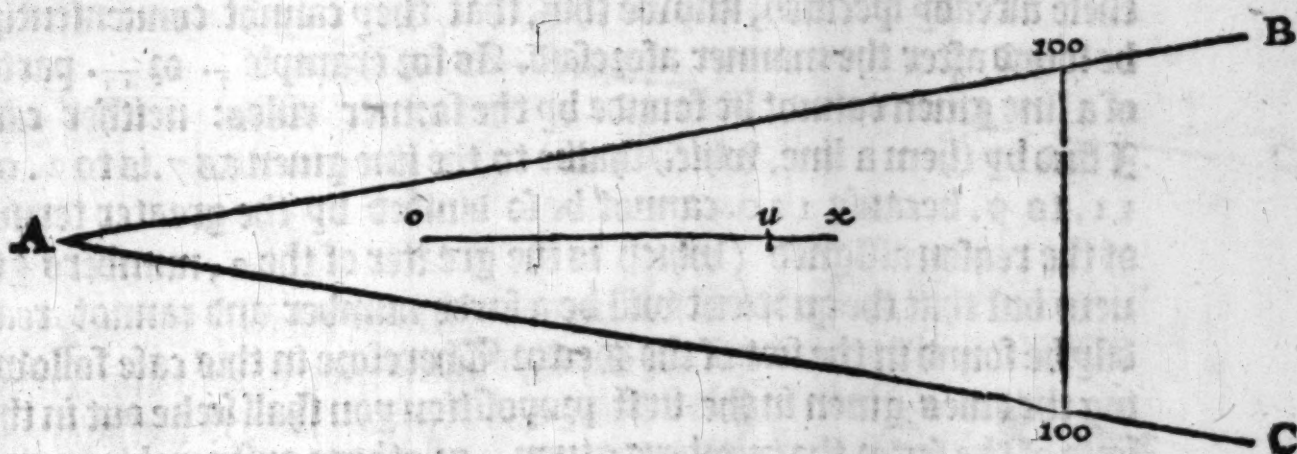


An example, wherein the line sought for is greater
then the line giuen.



Et the line giuen be o u. and let the proportion assigned be as 6. is to 5. I desire to finde a line, which shalbe to o u. in such proportion as 6. is to 5. By the proportionall numbers I know, that the line sought for is greater then the line giuen, therefore in this case I must continue out in length the line o u.

o u. Secondly multiplying 120. by 5. and diuiding the product by 6. I find 100. in the quotient, which is to 120. as 5. to 6. I seeke out that number in the feet of the Sector, and taking with my compasse the length of the line giuen o u. I set the one foote of them in the 100. partition of the left foote of the Sector, and moue the right foote to and fro, untill the other foote of the compasses toucheth the 100. partition of that foote of the Sector. The line containd betwene the pointes of the Sector, being counted from o. in the line o u. to the point x. at all aduentures falling out in the same line shall be in such proportion to the line o u. as 6. is to 5. as may bee proued by the sozenamed positions of Ramus in this demonstration following.



By these examples you may gather, that it is possible to find many proportions both of a lesser line to a greater, and of a greater to a lesser line. You shall finde a lesser line, which shall bee $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}$ part of a greater line giuen by setting the pointes of the Sector on the endes of the line giuen, and taking with your compasses the distance from one foote to another in the 60. 40. 30. 24. 20. 15. 12. 10. 8. 6. 5. 4. 3. 2. and 1. part of the Sector. Agayne, you shall find a lesser line, which shall be $\frac{2}{3}, \frac{2}{5}, \frac{2}{7}, \frac{3}{4}, \frac{3}{5}, \frac{3}{8}, \frac{4}{5}, \frac{4}{7}$ partes of the greater line giuen by setting the pointes of the Sector on the endes of the line giuen, and taking with your compasses the distance from one foot to another in the 80. 48. 16. 90. 72. 45. 18. 96. and 32. part of the feet of the Sector.

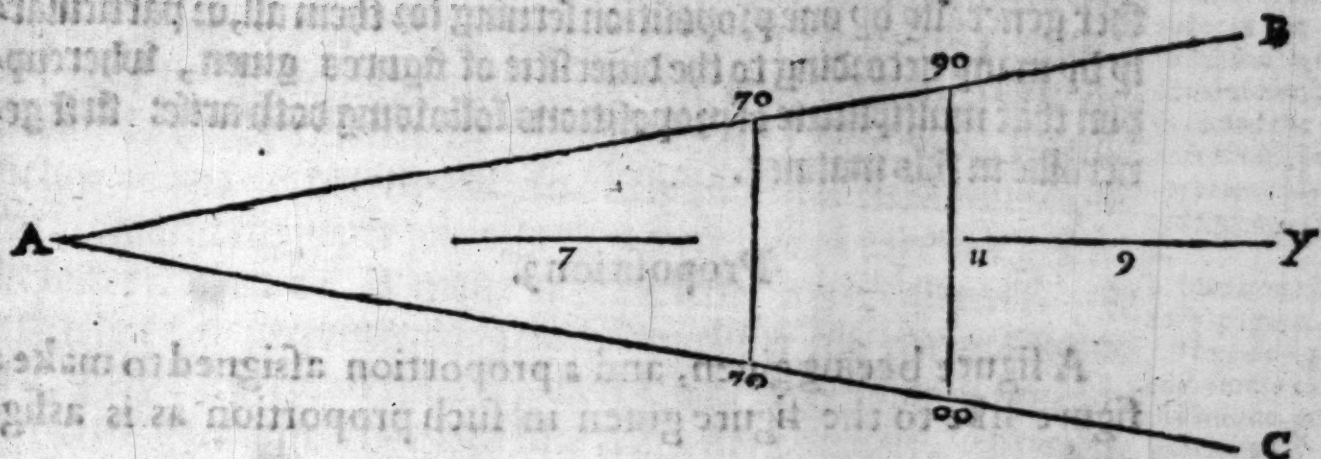
The vse of the Sector.

You shall find a greater line which shall be, 2. 3. 4. 5. 6. 8. 10. 12. 15. 20. 24. 30. 40. 60. 720. times so great, as the lesser line given. If wth your compasses you take the length of the lesser line given, and apply them to the 60. 40. 30. 24. 20. 15. 12. 10. 8. 6. 5. 4. 3. 2. and 1. part of each foot of the Sector. Again you shall finde a greater line which shall be to the lesser line as 3. is to 2. as 5. is to 2. as 15 is to 2. as 4 is to 3. as 5 is to 3. as 8. is to 3. as 20. is to 3. as 5. is to 4. as 15. is to 4. if wth your compasses you take the length of the lesser line given, and apply them to the 80. 48. 16. 90. 72. 45. 18. 96. and 32. part of each foot of the Sector: for the distance between the pointes of the sector affordeth the line required.

If you desire to find more varietie of proportionall lines, then these already specified, knowe this, that they cannot conveniently be found after the manner aforesaid. As for example $\frac{7}{2}$. or $\frac{11}{9}$. parte of a line given cannot be founde by the former rules: neither can I find by them a line, which shall be to the line given as 7. is to 2. or 11. to 9. because 120. cannot be so diuided by the greater terme of the reason assigned (which is the greater of the 2. numbers given) but that the quotient will be a surde number, and cannot readily be found in the feet of the Sector. Therefore in this case following the rules given in the first proposition you shall seeke out in the feet of the sector the numbers given, or others answerable in proportion to them. Then taking wth your compasses the length of the line given, and applying them either to the greater number in each foote of the Sector, if you seeke for a lesser line, or to the lesser number, if you seeke for a greater line, the distance between the number in each foot of the sector to which the feet of the compasses was not applied shall yeeld the proportionall line required. One example will make this rule plaine.

Let the line given be uy . and let the proportion assigned be as 7. is to 9. I desire to find a line, which shall be to uy . as 7. is to 9. By the proportionall numbers given I know, that the line sought for is lesser then the line given, but I cannot find it out by the directions given in the beginning of this proposition, because there is no rationall number to be found hauing such proportion to 120. as 7. hath to 9. Therefore following the prescript given in the first proposition in steade of 7, and 9. I take 70. and 90. and seeke out those numbers

bers in each foote of the Sector. Then taking with my Compasses the length of the line $u y$. I applie it to 90. the greater number, because I seeke for a lesser line, the distance from 70. to 70. in each foote of the Sector yeeldeth the proportionall line required as may be proued by the forenamed proportions of Ram. in this demonstration following.



By this meanes you may finde a line hauing such proportion to a line giuen as is assigned, so that the greater terme of the proportion assigned excede not 120. as I said before.

Now for so much as the proportion of figures ariseth out of the proportion of lines (as may be proued by the first consectary of the 15. p. of the fourth b. of Ram.) and the proportion of lines may be found out most readilie by the seete of the Sector, therefore it is possible also by the Sector to make any geometricall figure, which shall haue such proportion to the figure assigned as the proportion assigned shal require. It is possible also to diuide a figure giuen in such proportion as is assigned.

Mentioned before pag 4. a.

In making of one figure proportionall to another figure giuen these thinges are to be considered, whether we will make the figure both proportionall, and also like the figure giuen, or whether wee will make it onely proportionall but not like to the figure giuen. Item we are to consider whether the proportionall figure, which is to be made ought to bee greater or lesser then the figure giuen: for as it is in the lines, so it falleth out in figures, that a greater figure may be giuen, and a lesser is sought for, or a lesser figure may be giuen, and a greater is sought for.

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Item sometimes we seeke for the proportion of the whole figure to the whole figure giuen: sometimes we seeke not for the proportion of the whole figure to the whole figure, but onely for the proportion of the perimeter of the figure, to the perimeter of the figure giuen, which is commonly called the translating of a platte from one scale vnto another.

The making of these proportionall figures, may bee taught either generally by one proposition seruing for them all, or particularly by many according to the diuersitie of figures giuen, wherupon that multiplicitie of propositions following doth arise: first generally in this manner.

Proposition 3.

A figure beeing giuen, and a proportion assigned to make a figure like to the figure giuen in such proportion as is assigned.



In this proposition there are two things required, the one is to make a figure proportionall to the figure giuen, the other is to make it like to the figure giuen. And for so much as every figure made, eyther like, or proportionall to a figure giuen, must haue some line, vppon the which it must be made: therefore the first labour in performing this proposition is this, to finde that proportionall line, vppon the which the figure must bee made like to the figure giuen in such proportion as is assigned.

The figure giuen may be either a circle, or a right lined figure. If it be a circle, take the diameter thereof, if it be a right lined figure take the side thereof, and by the 2. proposition of this booke seeke out a line, which shall bee to the line taken, in such proportion as is assigned. Ioyne those 2. lines in one so, that they may make one right line, and marke the point wherein they were ioyned together. Let that line be the diameter of a semicircle, and from the point, wherein they were ioyned together, raise a line perpendicular to the diameter, touching the circumference in a point at all aduentures

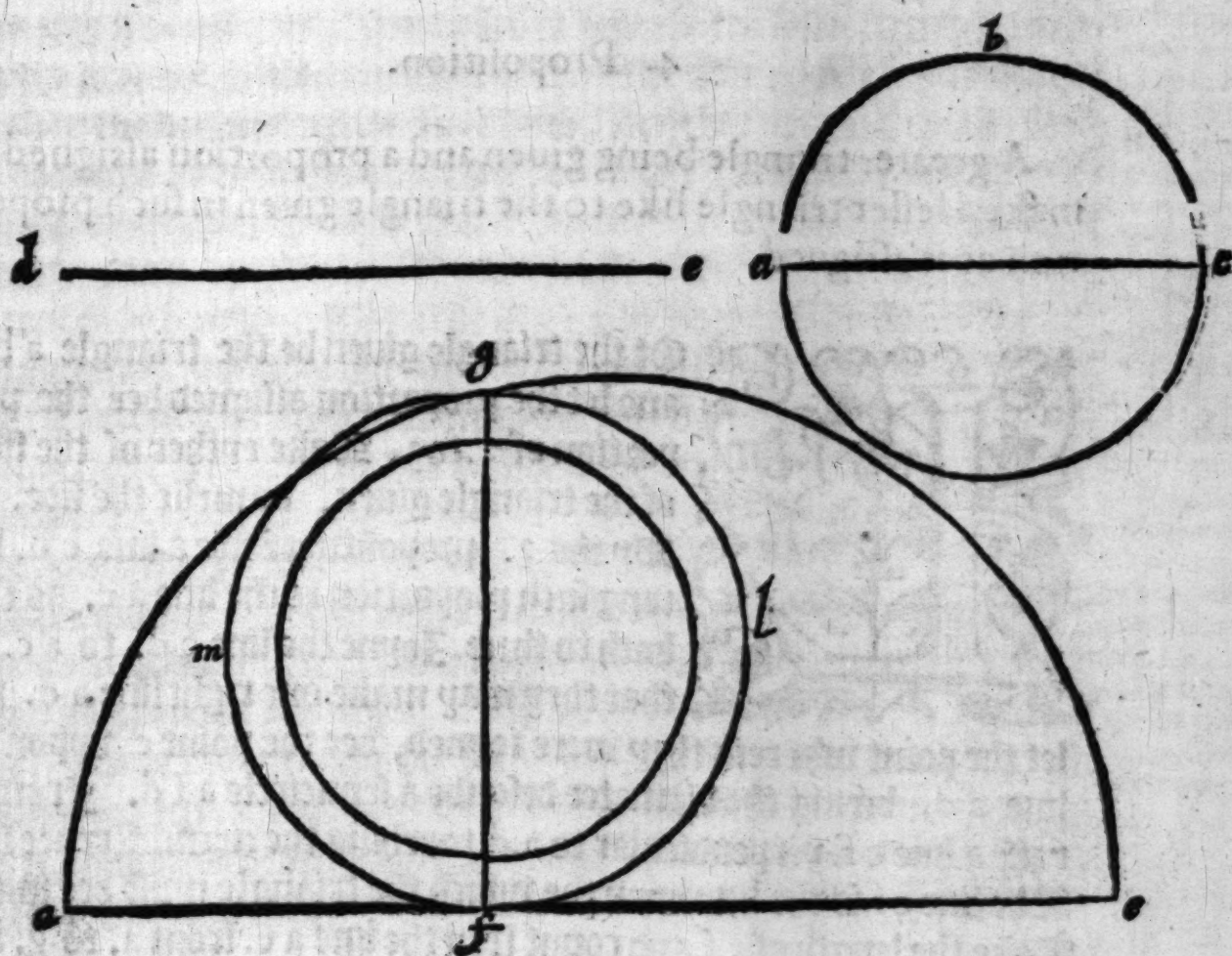
lines falling out, that perpendicular is the proportionall line, vppon which the figure sought for must be made, as may be prooued by the 19. p. of the 16. b, and b. the first consecutarie of the 15. p. of the 4. b. of Ram. One example will make this plaine.

Let the figure giuen bee the circle abc. and let the proportion assigned be the proportion of 3. to 2. It is required to finde a line, vppon which I may make a circle like to the circle giuen, and in such proportion as 3. is to 2. In the circle giuen I drawe the diameter ac. and by the second proposition of this booke I finde a line dc. hauing such proportion to the diameter ac. as 3. hath to 2, I ioyne the line ac. and dc. together so, that they both may make one right line ac. and at the poynt wherein they were ioyned together, I set the letter f. vpon ac. I make a semicircle. age. From f. I raise a line fg. perpendicular to ac. touching the circumference in g. I say the perpendicular fg. is the line, vppon which the proportionall figure must be made like to the figure giuen, as appeareth in the demonstration following.

a. If a right line continued of 2. right lines bee made the diameter of a circle, the perpendicular drawne from the point of the continuation to the circumference, shall bee the proportionall line betweene the lines giuen, 13. p. 6.

b. Mentioned before page. 4. a

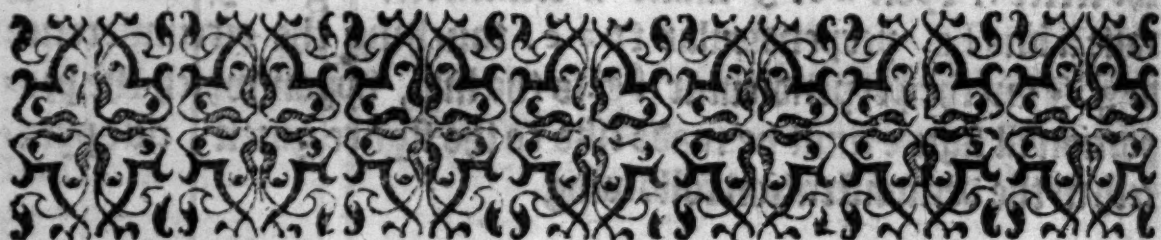
The line fg. is commonly called the meane proportionall.



This

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This rule is generall. Now the line being founde out, vppon which the figure should be made, it followeth to declare, how vppon that line the figure is to bee made like vnto the figure giuen. All circles are like one to another: therefore if a circle be made vpon the line found out, namely vpon the line fg . it shall bee both like, and proportionall to the circle giuen as was required to be done, and may be seene in the former demonstration in the circle $glfm$. But if the figure giuen bee a right-lined figure it is eyther a triangle or a triangulate, and eyther the lesser figure is sought for, or the greater, as was noted before: from this diuersitie of figures giuen, & sought, arise the particular propositions following.



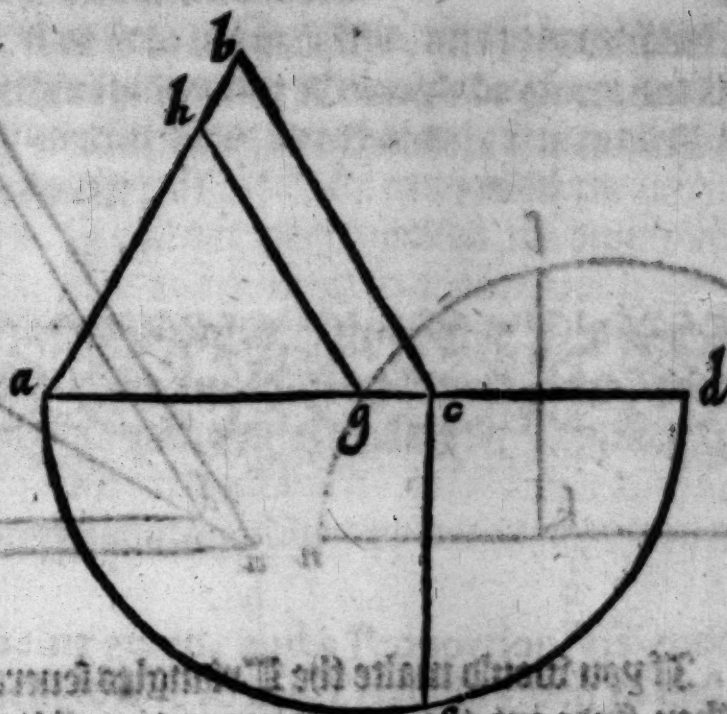
4. Proposition.

A greater triangle being giuen and a proportion assigned to make a lesser triangle like to the triangle giuen in such proportion as is assigned.



Et the triangle giuen be the triangle abc . and let the proportion assigned bee the proportion of 2. to 3. Take eyther of the sides of the triangle giuen, namely the side, ac . By the 2. proposition finde a line cd , hauing such proportion to the line ac , as two hath to three. Ioyne the line cd . to ac . so that they may make one right line ad . and let the point wherein they were ioyned, bee the point c vppon the line ad . being the diameter describe a semicircle afd . From c . raise a line cf . perpendicular to ad . touching the circumference in f . The line cf . is the line vpon the which the triangle must bee made. Take the length of cf . and count it in the line ac . from a . to g . and from

from g. drawe a line gh. parallell to c b. the side of the triangle. I say the triangle a h g. is like the triangle a b c. as may bee proued by the ^a. 14. p. of the 4. b. by the ^b. 8. p. of the 6. b. & by the ^c. 1. Consect. of 9. p. of the 7. b. of Ram. and it hath such proportion to the triangle a b c. as two hath to three, as may be proued by the ^d. Consect. of the 15. p. of the 4. b. in this demonstration.



a. Like figures are figures equi-angle. and proportionall in the feet of the equal angles.

b. Mentioned before. page 9. a.

c. If a right line in a triangle bee parallell to the base it cutteth off a triangle equi-angle to the whole triangle. and lesser in the base.

d. Mentioned before pag. 4. a.

e. If 2. right lines doe at right angles diuide into equall parts, the 2. sides of a right lined figure giue, the circle of the radius drawne from their concurse to the angle, shall bee circumscribed about the right lined figure giuen.

f. Mentioned before page. 9. a.

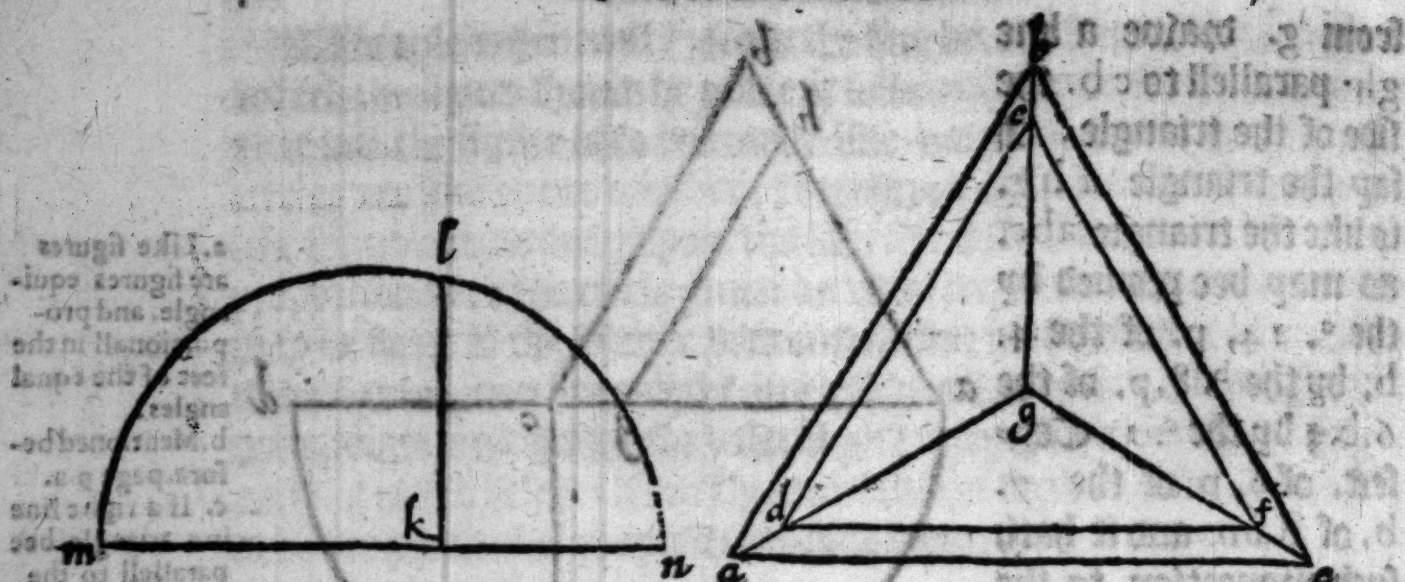
g. Mentioned before. pag. 14. a.

h. The angles, whose alternate seete are parallell, are equall.

i. Mentioned before page. 9. a.

k. Mentioned before pag. 4. a.

In the former demonstration the lesser triangle a h g. was made within the greater a b c. and had an angle at a. common with the greater triangle: but if you desire to describe the lesser triangle within the greater, so that each side of the lesser triangle def. (as appeareth in the demonstration following) may bee parallell to the sides of the greater triangle a b c. then doe thus: First seeke out the center of the greater triangle giuen (by the ^e. 5. p. of the 17. b.) and let it bee the point g. From g. to each angle of the triangle drawe right lines. ga. gb. and gc. Take the line ga. in steade of the side of the triangle giuen, and seeke out the proportionall line as you were taught by the second and third proposition of this booke, upon which the triangle must bee made (in this demonstration it is the line kl.) count the line kl. from g. in the lines ga. gb. and gc. to the pointes d. e. & f. and drawe the right lines de. ef. and fd. I say the lines de. ef. and fd. are parallell to the sides of the triangle a b c. as may bee proued by the ^f. 8. p. of the 6. b. and the triangle def. is like the triangle a b c. as may be proued. by the ^g. 14. p. of the 4. b. by the ^h. 4. consect. of the. 12. p. of the 5. b. and by the ⁱ. 9. p. of the 7. booke of Ram. It hath also such proportion to the triangle a b c. as two hath to three, as may be proued by the ^k. 1. consect. of the 15. prop. of the 4. booke in this demonstration.

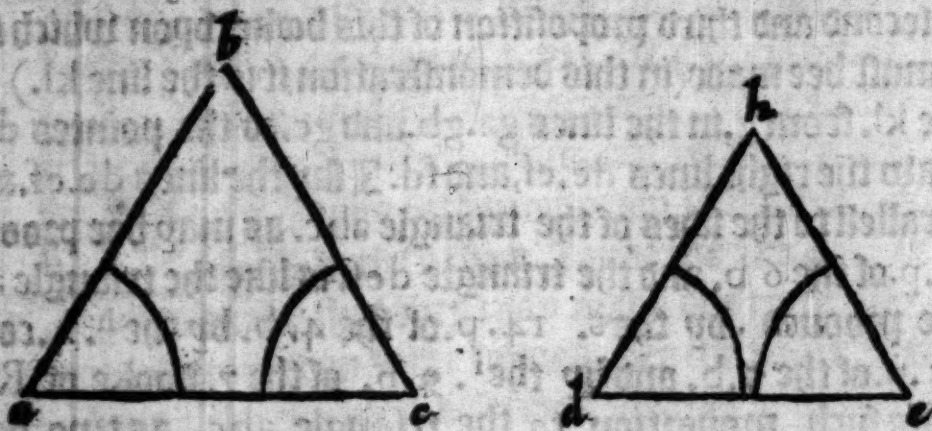


If you would make the Triangles several one without another, then finde out the meane proportionall line, as you were taught in the 3. Proposition, and in the beginning of this Proposition, which is in the first Demonstration the line c f. make a right line d c. equall to the said line c f. and at the point d. make an Angle h d c. equall to the Angle of the Triangle given b a c. Item at the point c. make an Angle d c h. equall to the Angle a c b. The Triangle d h c. is like the Triangle a b c. as may bee proued by the making of it, and by the 9. Proposition of the 7. b. and the 14. Proposition of the 4. booke. It is also in such proportion as is assigned as may be proued by the 1. Conf. of the 15. P. of the 4. B. in this Demonstration.

a. Mentioned before, pag. 9. a.

b. Mentioned before, pag. 14. a.

c. Mentioned before, pag. 4. a.



Here note, that this last kind of worke serueth for any kinde of Triangle.

Triangle whatsoeuer, that is to be made like, and proportional to a Triangle giuen, whether the greater Triangle be giuen, and the lesser be sought for, or contrariwise, and therefore it is needlesse to repeate it any moze hereafter.

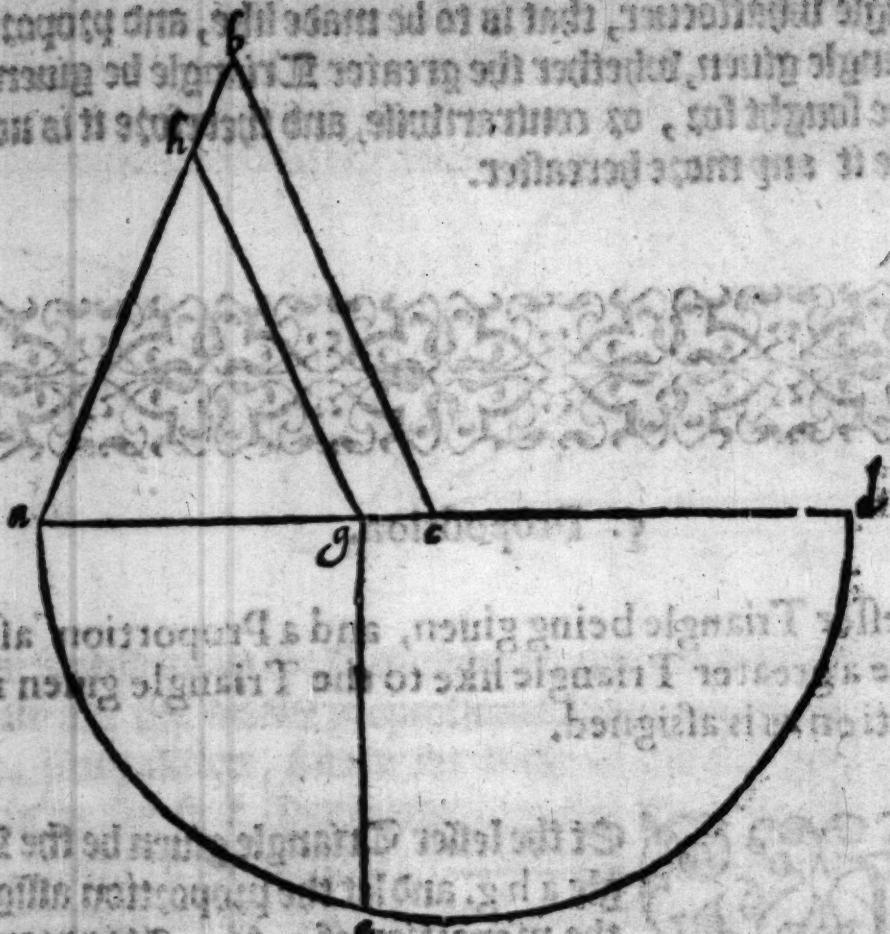


5. Proposition.

A lesser Triangle being giuen, and a Proportion assigned to make a greater Triangle like to the Triangle giuen in such proportion as is assigned.

Let the lesser Triangle giuen be the Triangle ahg . and let the proportion assigned be the proportion of 3. to 2. It is required to make a greater Triangle like to the Triangle ahg . hauing such proportion to it as 3. hath to 2. Take either of the sides of the Triangle giuen namely the side ag . by the 2. Proposition find a line gd . hauing such proportion to the line ag . as 3. hath to 2. Ioyne the line gd . to the line ag . at the point g . so, that they make one right line ad . upon ad . being the Diameter describe a Semicircle acd . From g . draw a line gc . perpendicular to ad . touching the Circumference in c . Then continue out in length the sides of the Triangle giuen ag . and ah . In the line ag . continued count the length of the line gc . from a . to c . from c . draw a line cb . paralel to the side of the triangle gh . cutting the line ah . continued in the point b . I say the Triangle abc . is greater then the Triangle giuen for it containeth it, and it is like the Triangle giuen, and also proportionall in such proportion as is assigned, as may be prooued by the Propositions of Ramus, mentioned befoze, in this Demonstration following.

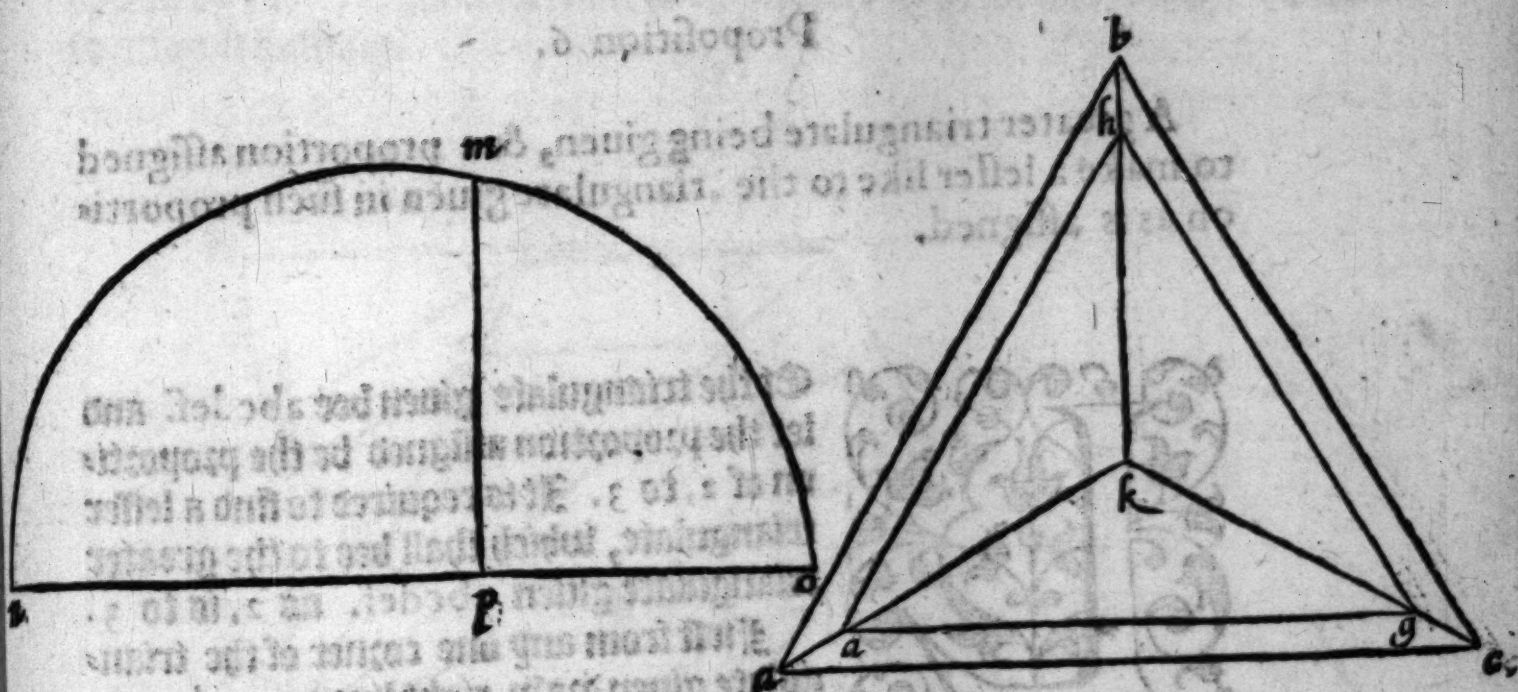
The vse of the Sector.



In the former demonstration the greater triangle sounde out
 abc . comprehendeth the lesser triangle giuen, ahg . so that the angle
 at a . is common to them both: But if you desire so to describe the
 greater triangle abc . about the lesser triangle ahg . that each side of
 the greater triangle may be parallel to each side of the lesser, then
 doe thus: First seeke out the center of the lesser triangle, ahg . by
 the 5. prop. of the 17 booke of Ram. and let it be the point k . from
 k . to each angle of the triangle draw right lines ka , kh , kg . conti-
 nuing them out at length as farre as you thinke convenient. Take
 the line ka . in steade of the side of the triangle giuen, and seeke out
 the meane proportionall line as you did before, in this demonstrati-
 on it is the line pm . Count this line pm . in the lines ka , kh . and kg .
 from the point k . to the pointes abc . and draw the right lines ab .
 bc . and ca . making the triangle abc . about the lesser triangle.
 I saye the lines ab . bc . ca . are parallelles to the sides
 of

Mentioned be-
 fore pag. 14.2.

sides of the lesser triangle and the greater triangle abc . is like and proportionall to the lesser triangle in such proportion as is assigned: as may be proued by the propositions mentioned before the seconde demonstration of the 4. proposition in this demonstration following.



Thus much concerning the circle and the triangle. It followeth now to speake of the triangulate. A triangulate is a right lined figure made of triangles. i. p. of the 10. b. of Ramus: And considering that infinite triangles may be packed together to make a right lined figure, therefore the severall kindes of a triangulate may be also infinite, but the manner of making a triangulate like, and proportionall to a triangulate given is not much differing in them all, whether they be Quadrangles or Multangles, and both little vary from that, which hath bene heretofore set downe concerning triangles, so that it were needeles to write thereof, were it not to satisfie those, which thinke the matter strange for want of practise in Geometricall descriptions. Out of the manifold kindes of triangulates, I will choose onely the multangle irregulare figure: in the handling whereof I will keepe the same manner of discourse, which I followed

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followed in the triangle declaring both inclusively, and exclusively how the one may be made like and proportional to the other in any proportion assigned, whether the proportion be of the greater or lesser inequality, that thereby the one discourse may give light to the other, if eyther of them seeme obscure in any point.

Proposition 6.

A greater triangulate being giuen, & a proportion assigned to make a lesser like to the triangulate giuen in such proportion as is assigned.



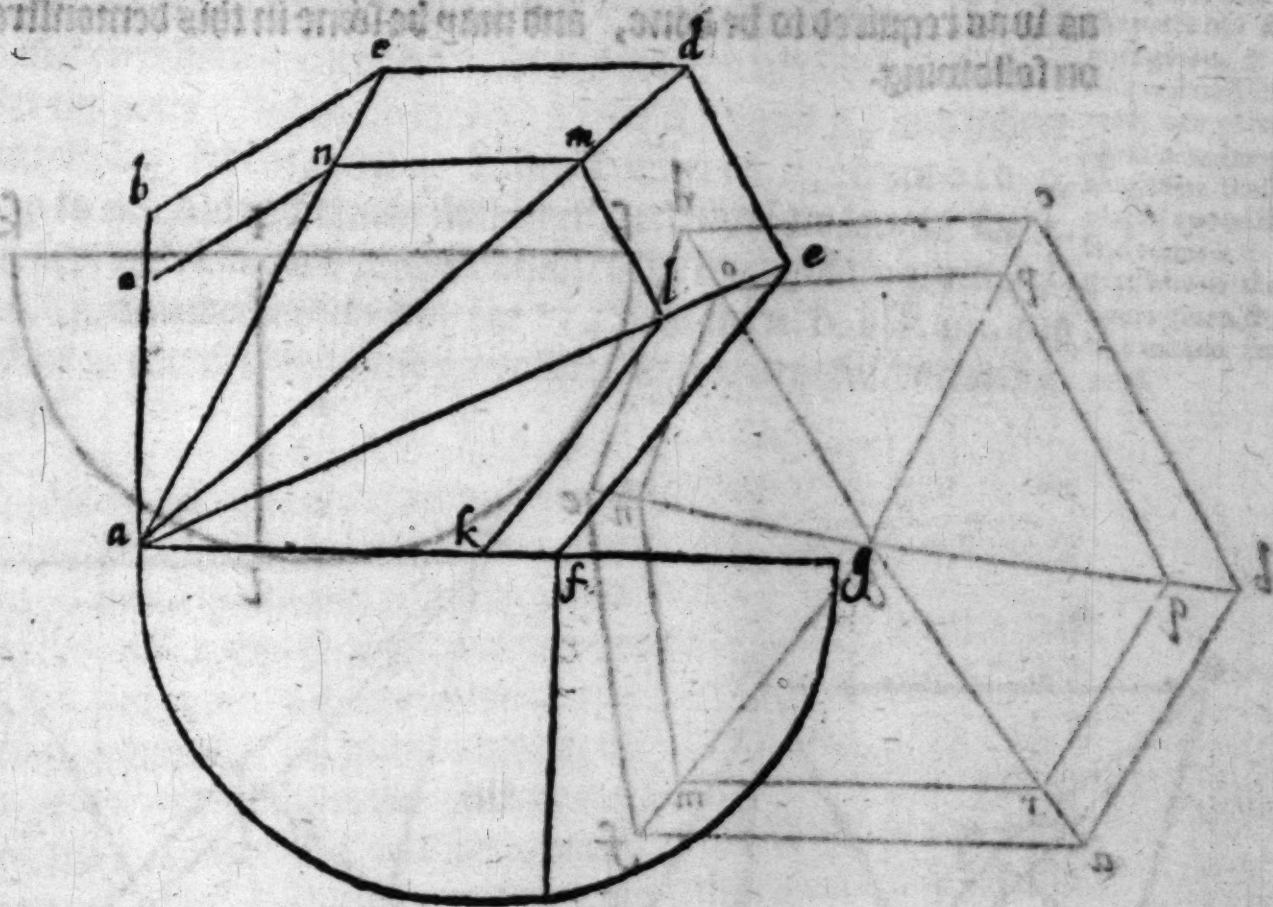
^aThe sides of a triangulate are more by 2. then the triangles whereof it is made.

Et the triangulate giuen bee abcdef. and let the proportion assigned be the proportion of 2, to 3. It is required to find a lesser triangulate, which shall bee to the greater triangulate giuen abcdef. as 2. is to 3.

First from any one corner of the triangulate giuen draw right lines ac, ad, ae, to each corner of the triangulate, diuiding it into triangles. The triangles into which the triangulate is diuided, are alwayes fewer by two, then the sides of the triangulate, as may be proued by the 1. Conf. of the^a 1. p. of the 10. b. of Ramus, and is apparent in the demonstration following. The triangulate being thus diuided into his triangles, take any one side thereof, namely the side af. By the second proposition find a line fg. hauing such proportion to af, as 2. hath to 3. Ioyne the line fg. to the line af. at the point f. so that they may make one right line ag. Upon ag. being the diameter describe a semicircle ahg. From f. draw a line fh. perpendicular to ag. touching the circumference in h. Take the length of the line fh. and count it in the side of the triangulate, af. from a. to k. Draw a line kl parallel to fe. the side of the triangulate, cutting the line ae. in l. From l. draw a line lm. parallel to ed. cutting ad in m. From m. draw a line mn. parallel to dc. cutting the line ac. in n. From n. draw a line no. parallel to cb. cutting the line ab in o. I say that the

the triangulate figure a. o. n. m. l. k is lesser then the greater triangulate figure given, abcdef, for it is containd within it, and it is like the triangulate figure given, as may be proued both by the propositions before mentioned, and by the 2. p. of the 10. b. of Ra. It is also proportionall in such proportion as is assigned, as may be proued by the 1. Consecutarie of the 15. p. of the 4. b. in this demonstration following.

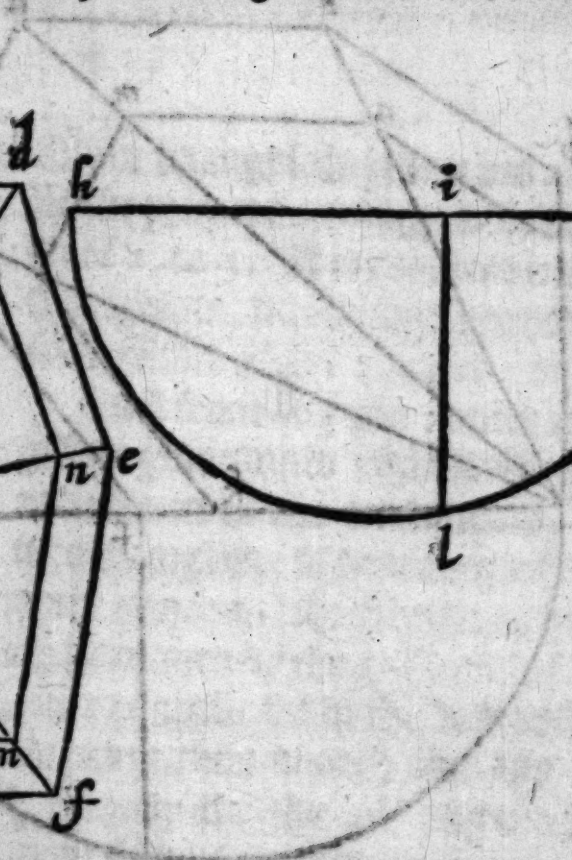
Like triangulate are diuided into triangles like one vnto another, & in proportion correspondent to the whole. Mentioned before pag. 4. a.



If you desire so to describe the lesser triangulate within the greater triangulate given, that each side of the lesser may bee parallel to each side of the greater take a poynthe g. in the middelt or neare to the middelt of the greater Triangulate, and from thence to each corner of the Triangulate draw right lynes. Then take any of those lines namely. gf. and seeke out by the second proposition a line ik, which shall be to gf. in such proportion as is

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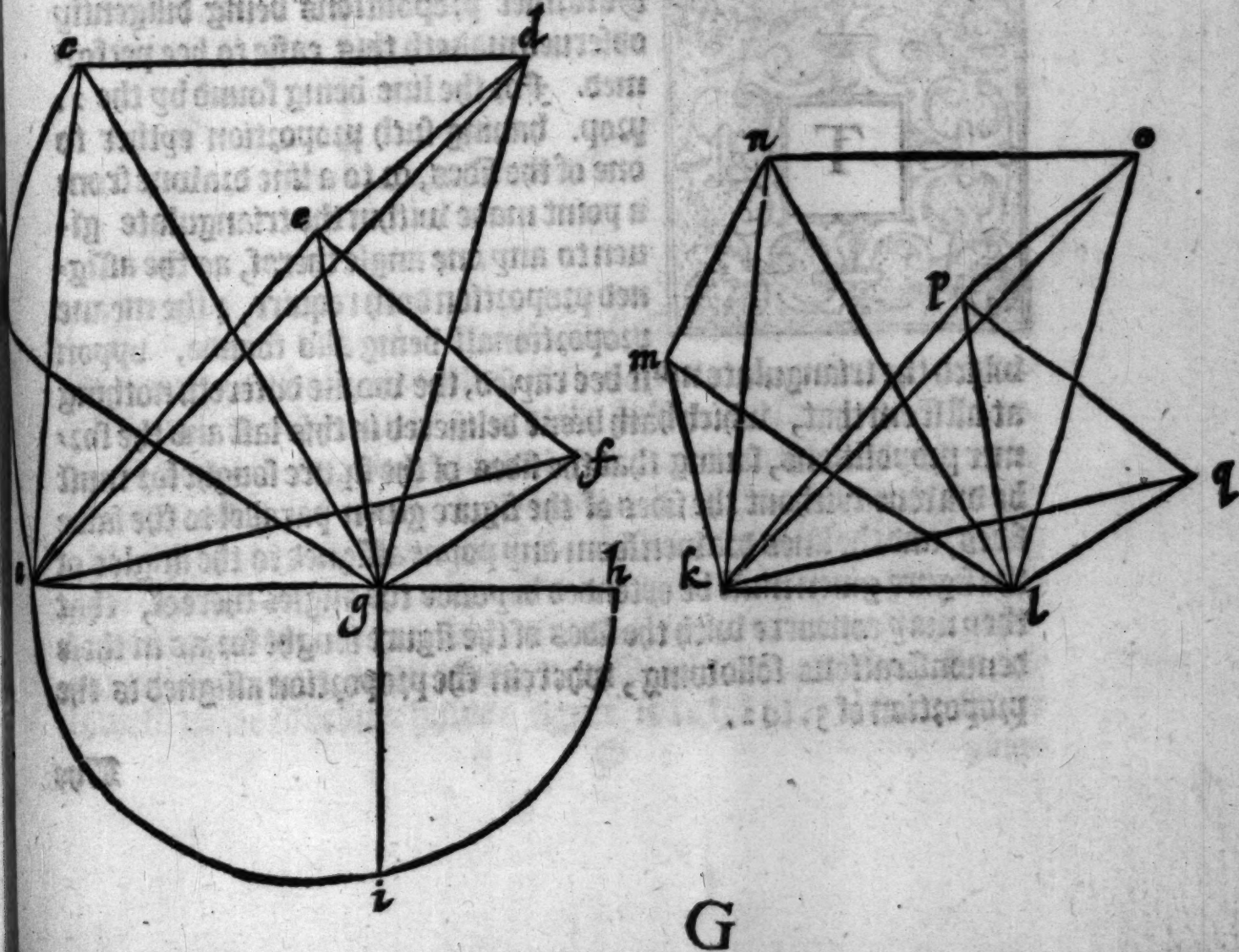
the whole
dependent so
in proportion to
the number of
light like one
is divided into
of like substance



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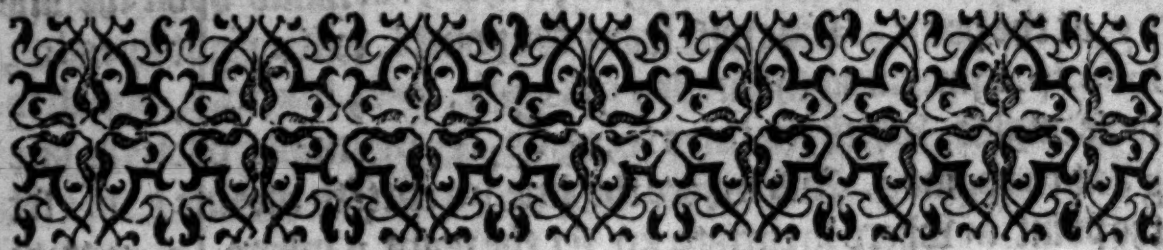
and by the 3. prop. seeke out the meane proportionall, and let it be the line gi . upon which the triangulate sought for must bee made like, and proportionall to the triangulate giuen. Take a line k like quall to the line gi , and first from the point k draw right lines km , kn , ko , kp , kq . making the angles mkl , nkl , okl , pkl , qkl . equall to those angles which the line ba , ca , da , ea , fa . make vpon the line ag , at the point a . Likewise from the point l , draw right lines lm , ln , lo , lp , lq . making the angles qlk , plk , olk , nkl , mkl , equall to those angles, which the lines fg , eg , dg , cg , bg . make vpon the line ga at the point g . And where the line lm cutteth the line km . set the point m where ln cutteth kn , set the point n where lo , cutteth ko , set the point o . where lp cutteth kp set the point p , and where lq cutteth kq , set the point q . Then from m to n , from o to p . from p to q . draw right lines making the triangulate sought for k . m , n , o , p , q , l . like, and proportionall to the triangulate giuen, a , b , c , d , e , f , g . as may be proued by the ^a 14. p. of the 4. b. of Ram. and the ^b 4. Conf. of the same proposition in this demonstration following.

a Mentioned before pag. 14. a.
b If parts like to the parts of a figure giuen, & in like manner situated, bee placed vpon a terme giuen, there shalbe placed vpon the said terme a figure like to the figure giuen, & in like manner situated.



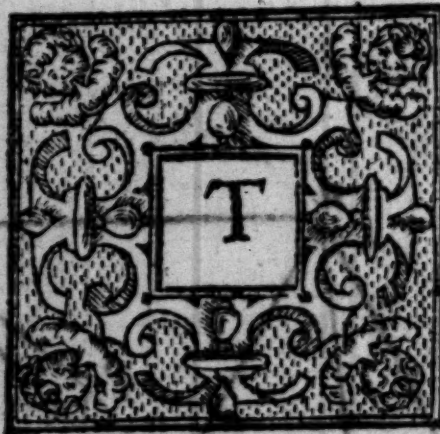
The vse of the Sector.

This kind of worke is generall in any kind of triangulate, whether the greater triangulate be giuen, and the lesser sought for, or contrariwise, so that it is needlesse to make any repetition thereof here after.



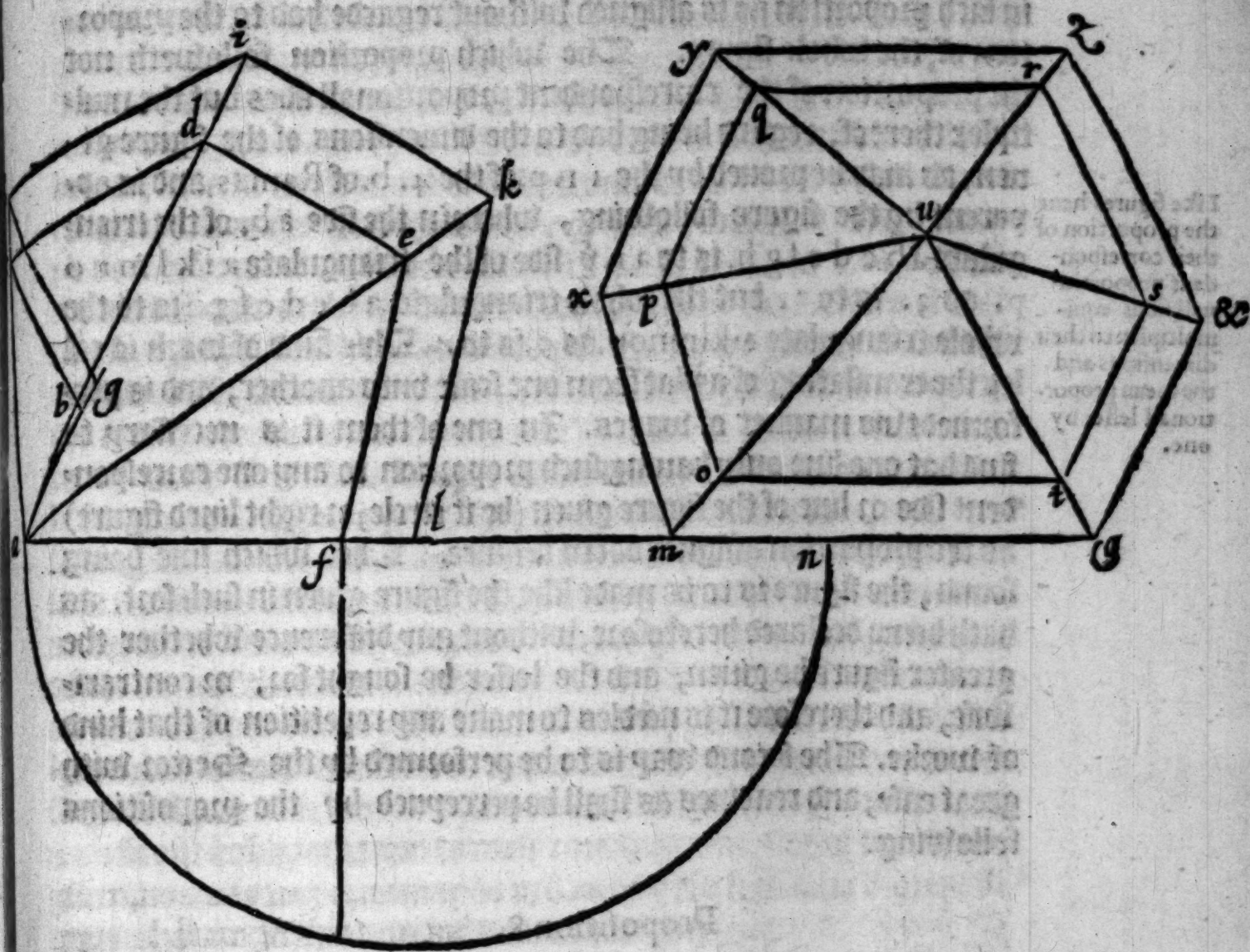
Proposition 7.

A lesser triangulate being giuen, and a proportion assigned to find a greater, which shall be to the lesser in such proportion as is assigned.



The former propositions being diligently obserued maketh this easie to bee performed. For the line being found by the 2. prop. hauing such proportion eyther to one of the sides, or to a line drawne from a point made within the triangulate giuen to any one angle thereof, as the assigned proportion doth require, & the meane proportionall being also founde, vppon which the triangulate must bee rayled, the worke differeth nothing at all from that, which hath bene deliuered in this last and the former propositions, sauing that the sides of the figure sought for must be drawne without the sides of the figure giuen parallel to the saide sides, and the lines drawen from any point assigned to the angles of the figure giuen must be extended beyonde the angles thereof, that they may concur with the sides of the figure sought for, as in these demonstrations following, wherein the proportion assigned is the proportion of 3. to 2.

The



A figure being given and a proportion assigned to make
 like figure, whose sides shall be to the sides of the figure given in
 the line $f n$ is to the line $a f$ in the first demonstration, and to
 the line $u o$ in the seconde, as 3. is to 2. and $f m$. is the meane pro-
 portionall, to which the line $a l$. in the first demonstration, and $u w$.
 in the second is equall. Hitherto you haue seene the manner how
 to make a whole figure like, and proportionall to a whole figure gi-
 uen, without the knowledge of the Arithmetick length of the side
 of the figure found out; which side in truth cannot be knowne but
 in surde numbers, except the numbers of the proportion assigned be-
 ing multiplyed one by an other can make a square number. It fol-
 loweth nowe to deliuer howe a figure is to bee made like a figure
 given

Like figures haue
the proportion of
their correspon-
dent proportion-
all sides equi-
multiplex to their
dimensions and
the mean propor-
tionall lesser by
one.

giuen, hauing his sides proportionall to the sides of the figure giuen in such proportion as is assigned without regarde had to the proportion of the whole figure. The which proportion followeth not the proportion of the correspondent proportionall sides but the multiplier thereof, regard being had to the dimensions of the figure giuen, as may be proued by the 11. p. of the 4. b. of Ramus, and is apparent by the figure following, wherein the side ab of the triangulate $abcdefgh$ is to a i . y side of the triangulate $aiklmnop$ as 3. is to 2. but the whole triangulate $abcdefgh$ is to the whole triangulate $aiklmnop$ as 9. is to 4. This kind of worke is called the translating of a plat from one scale vnto another, and is performed two manner of wayes. In one of them it is necessary to find but one line only hauing such proportion to any one correspondent side or line of the figure giuen (be it circle, or right lined figure) as the proportion assigned doeth require. The which line being found, the figure is to be made like the figure giuen in such sort, as hath bene declared heretofore, without any difference whether the greater figure be giuen, and the lesser be sought for, or contrariwise, and therefore it is needles to make any repetition of that kind of worke. The second way is to be performed by the Sector with great ease, and readines as shall be perceyued by the propositions following.

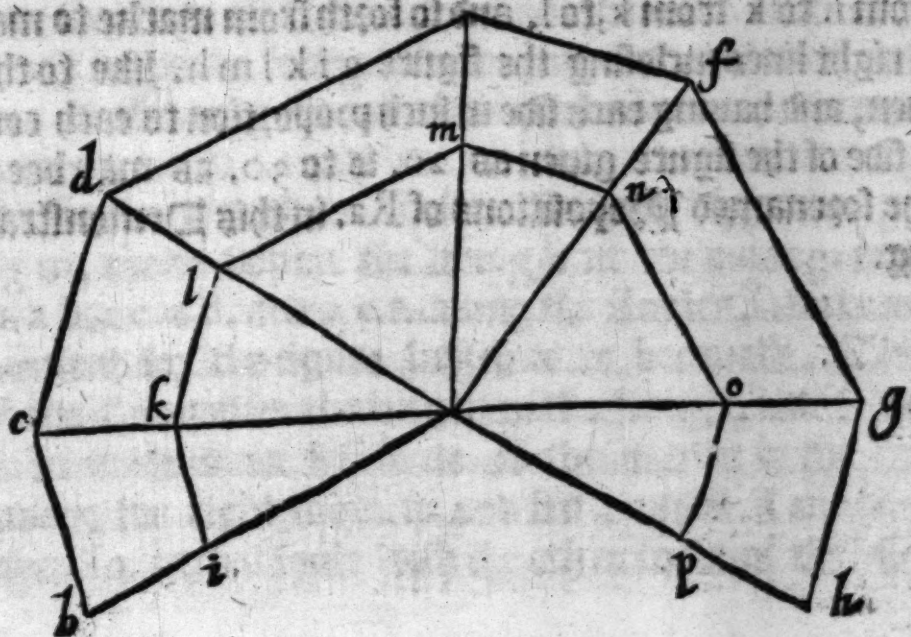
Proposition 8.

A figure being giuen and a proportion assigned to make a like figure, whose sides shalbe to the sides of the figure giuen in such proportion as is assigned.



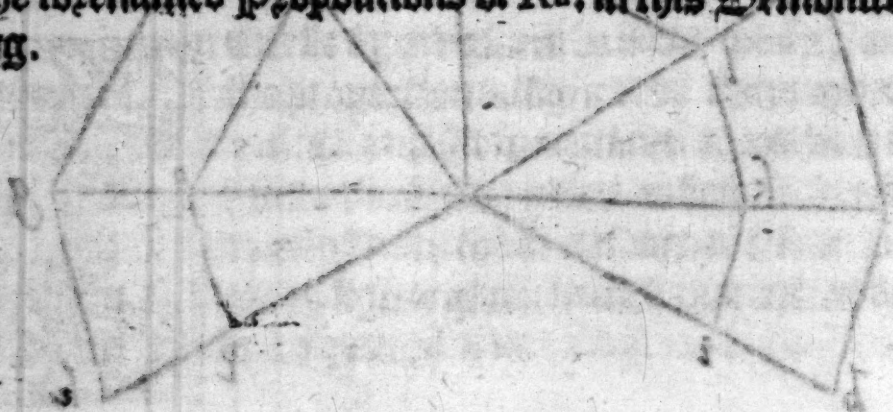
Et the figure giuen be $abcdefg$, and let the proportion assigned be the proportion of 20. to 30. It is required to make a figure like to the figure giuen whose seuerall sides should bee to the correspondent seuerall sides of the figure giuen in such proportion as 20. is to 30.

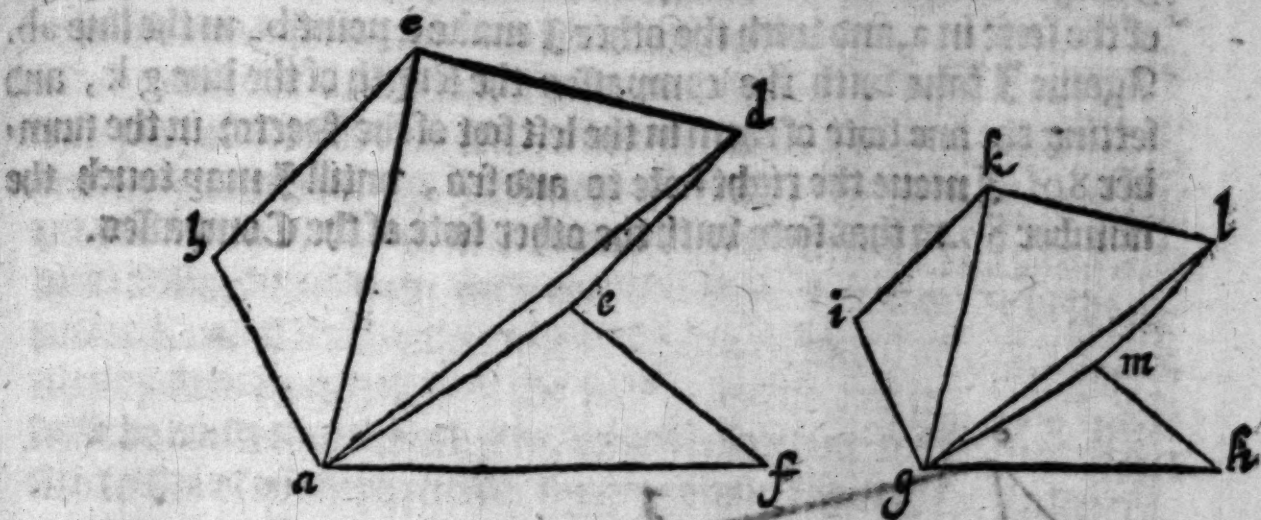
By the proportionall numbers giuen, I gather that the figure sought for is lesser than the figure giuen: therefore from some point eyther in the side or in the area of the figure giuen, I drawe right lines to each angle therof, not extending them beyond the angles as from a, to b, from a, to c, &c. Then by that which hath bin taught before, I seeke out a number which may be to 120 as the lesser of the proportionall numbers is to the greater, which in this example is 80, for as 20 is subsequialiter to 30, so is 80, to 120. This number I note in the feete of the Sector, for by the meanes of that number I shall make the figure like to the figure giuen. I set the pointes of the Sector in a, and b, and with the compasses (keeping the feete of the Sector at their extent) I take the distance from 80, to 80, in the feete of the Sector. This distance I count in the line a b, from a, to i. Againie I set the pointes of the Sector in a, and c, &c. taking the distance from 80 to 80, in the feet of the Sector I count it in the line ac, from a, to k. This worke I iterate so often times, as there are lines remainyng in the figure giuen, stil making markes at the ends of the severall distances counted in the said severall lines, as you may perceave by the letters l m n o p. When from i, to k, from k, to l, and so forth from marke to marke I drawe right lines, inclosing the figure a i k l m n o p, like to the figure giuen, and hauing each side in such proportion to each correspondant side of the figure giuen, as 20 is to 30, as may be proued by the sozenamed propositions of Ram, in this demonstration following.



The vse of the Sector.

In the former example the greater figure comprehended the lesser. In the example following they are severed one from another the which I here set downe because it hath a little difference in the working. Let the figure giuen be $a b c d e f$. Let the proportion assigned be as 20. is to 30. It is required to make a figure severed by it selfe like to the figure giuen, whose sides shall be to the correspondent sides of the figure giuen as 20. is to 30. First from the end of any one side of the figure giuen namely from a . I drawe right lines to each Angle: Secondly I seeke out a number in the scale of the Sector, which may bee to 120. as 20. is to 30. that number is 80. which I note in the scale. I set the points of the Sector in the line $a f$. and take the distance betwene 80. and 80. in the scale of the Sector, and according to that distance I drawe a line $g h$. vpon that line at the point g . I make Angles equall to those, which the right lines $b a$, $c a$, $d a$, and, $e a$, make vpon the line $a f$. at the point a . extending the lines $g i$, $g k$, $g l$, and $g m$. making the Angles, so farre as I thinke conuenient for the figure which is to be made. Then I set the points of the Sector in a . and b . and with the Compasses I take the distance betwene 80. and 80. in the scale of the Sector, and count that distance in the line $g i$. from g . to i . Again I set the points of the Sector in a . and c . and take the distance betwene 80. and 80. in the scale of the Sector, and count that distance in the line $g k$. from g . to k . This worke I iterate so often as there are lines remaining in the figure giuen, still making markes in the lines drawne from the point g . Then from i . to k . from k . to l . and so forth from marke to marke I draw right lines inclosing the figure $g i k l m h$. like to the figure giuen, and hauing each side in such proportion to each correspondent side of the figure giuen as 20. is to 30. as may bee proued by the sozenamed Propositions of Ra. in this Demonstration following.



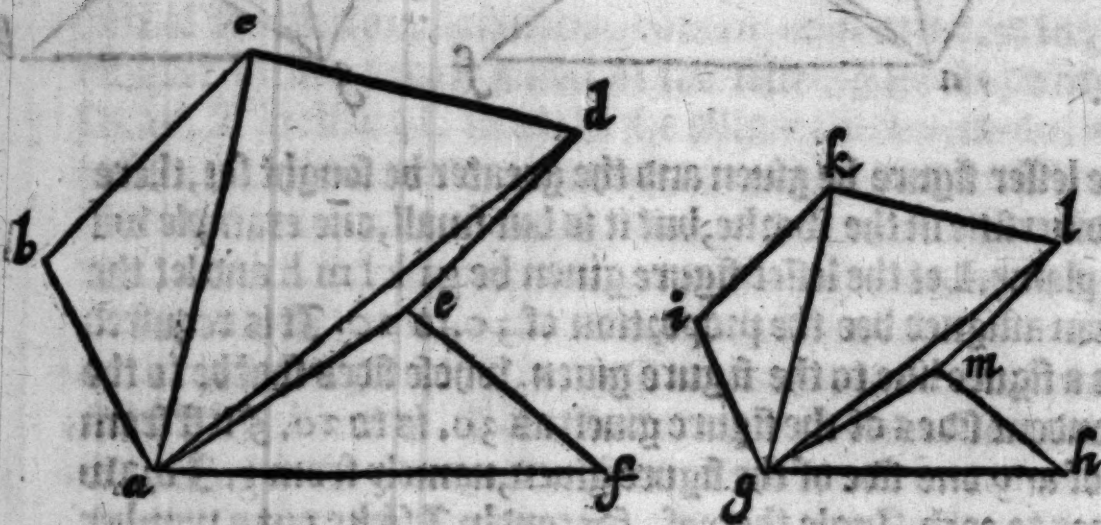


If the lesser figure be given and the greater be sought for, there is some diversitie in the worke, but it is but small, one example will make it plaine. Let the lesser figure given be $giklmh$ and let the proportion assigned bee the proportion of 30. to 20. It is required to make a figure like to the figure given, whose sides shal be to the correspondent sides of the figure given as 30. is to 20. First from the end of any one side of the figure given, namely from g . I draw right lines to each Angle thereof. Secondly I seeke out a number in the scale of the Sector which may bee to 120. as 20. is to 30. that number is 80. which I note in the scale of the Sector, with the Compasses I take the length of the line gh . and setting the one foote of them in the left foote of the Sector in the number 80. I move the right foote to and fro, untill I may touch the number 80. in that foote of the Sector with the other foote of the Compasses: I keepe the scale of the Sector at their extent, and with the points of the scale I make two points a . and b . From the one to the other I draw a right line ab . upon that line at the point a . I make Angles equall to those, which the right lines gi . gk . gl . and gm . make upon the line gh . at the point g . extend the lines ab . ac . ad . and ae . making the Angles, so farre as I thinke convenient for the figure which is to bee made. Then I take with the Compasses the length of the line gi . and setting the one foote of them in the left foote of the Sector in the number 80. I move the right foote to and fro, untill I may touch the number 80. in that foote with the other foote of the Compasses.

I

The vse of the Sector.

I keepe the feete of the Sector at their extent, and set the one point of the feete in a, and with the other I make a point b, in the line ab. Again I take with the compasses the length of the line g k, and setting the one foote of them in the left foot of the Sector in the number 80. I moue the right foote to and fro, untill I may touch the number 80. in that foote with the other foote of the Compasses.

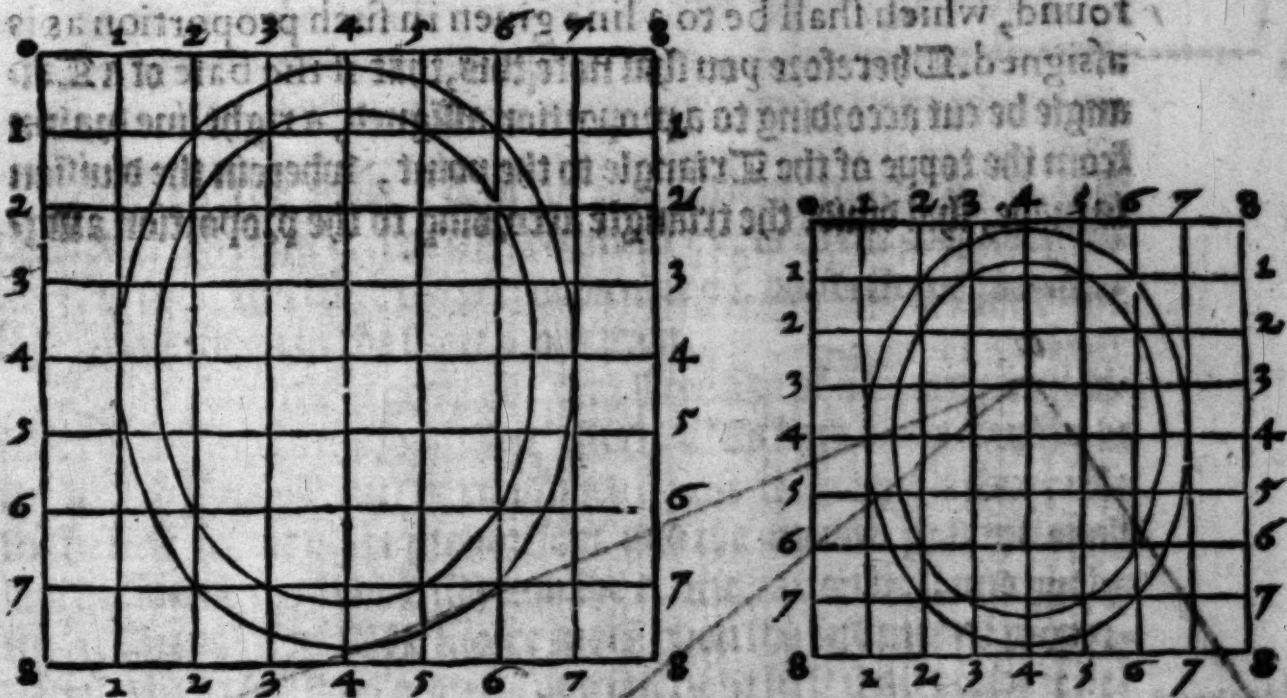


I keepe the feete of the Sector at their extent, and set the one point of the feete in a, and with the other I make a point c, in the line ac, This worke I iterate so often, as there are lines remaining in the figure giuen still making markes in the lines drawne from the point a. Then from b, to c, from c, to d, and so forth from marke to marke I draw right lines inclosing the figure, a b c d e f, like to the figure giuen, and hauing each side in such proportion to each correspondent side of the figure giuen as 30, is to 20 as may bee proued by the forenamed propositions of Ram. in the demonstration set downe before.

Thus much concerning the Geometricall figures like and proportionall one to another. I call those Geometricall figures. which may be made with the Ruler and Compasse according to the rules of Geometrie: But if the figure giuen be not Geometricall, then cannot another figure be made like and proportionall vnto it
by

by the Sector without tedious labour, except we use this meanes.
 Inclose the figure given within a square (I might say within any
 Geometricall figure, but a Square, or else an oblong is fittest for
 this purpose) divide that square into so manie particular squares as
 you may conveniently (the more the better) by dividing each side
 into 8. 16. 32. 64. or into as many even parts as you please, and
 by drawing lines unto each correspondent section made in the op-
 posite sides. Then by the rules before given make an other square
 having such proportion to the former square, as is assigned, and
 let it be divided as the other is, which being done draw lines from
 side to side of every particular square contained in this second square,
 cutting their sides as they shall fall out in such manner as the sever-
 all lines of the figure given, and inclosed in the first square cutteth
 the sides of each particular square contained therein: so shall you
 make a figure like and proportionall to the figure given of what
 fashion so ever it is, as may be proved by the fourth Confectarie
 of the fourteenth Proposition of the 4. booke of Ram. in this De-
 monstracion following.

Mentioned be-
 fore pag. 14. 2.



H

9 Proposition

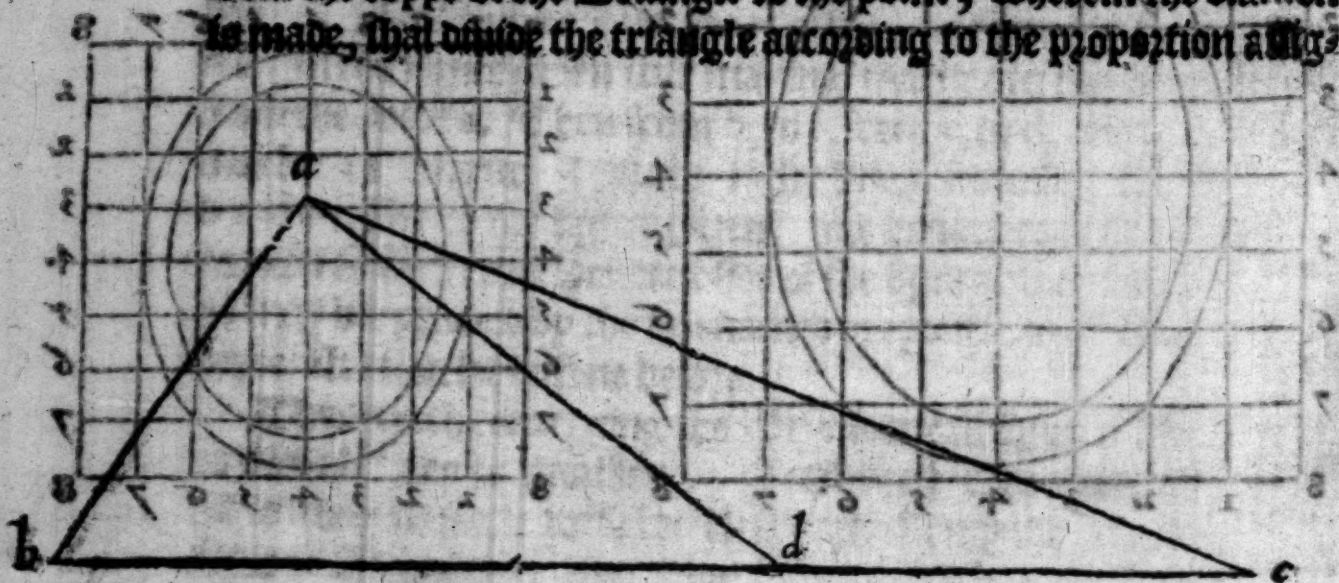
The vse of the Sector.

9. Proposition.

To diuide a figure given according to a Proportion assigned.



Figures may bee diuided diuers waies: for sometimes they are diuided by one line only, and that line is drawne from an Angle to the side subtending the Angle, sometimes ther is a point giuen in one of the sides, and the line making the diuision is drawne to the opposite either Paralel or not Paralell to an other side assigned: sometimes the figure is diuided by many lines. But it is not my purpose in this Treatise to set them all downe, because they require a longer discourse, then I intend in the vse of the Sector: Therefore I will content my selfe with those few, which offer themselves in the former descriptions, and may be gathered out of them. It hath bene declared in the second Proposition of this booke, how a line may be found, which shall be to a line giuen in such proportion as is assigned. Therefore you shal note this, that if the base of a Triangle be cut according to a proportion assigned, a right line drawne from the toppe of the Triangle to the point, wherein the diuision is made, shal diuide the triangle according to the proportion assigne.



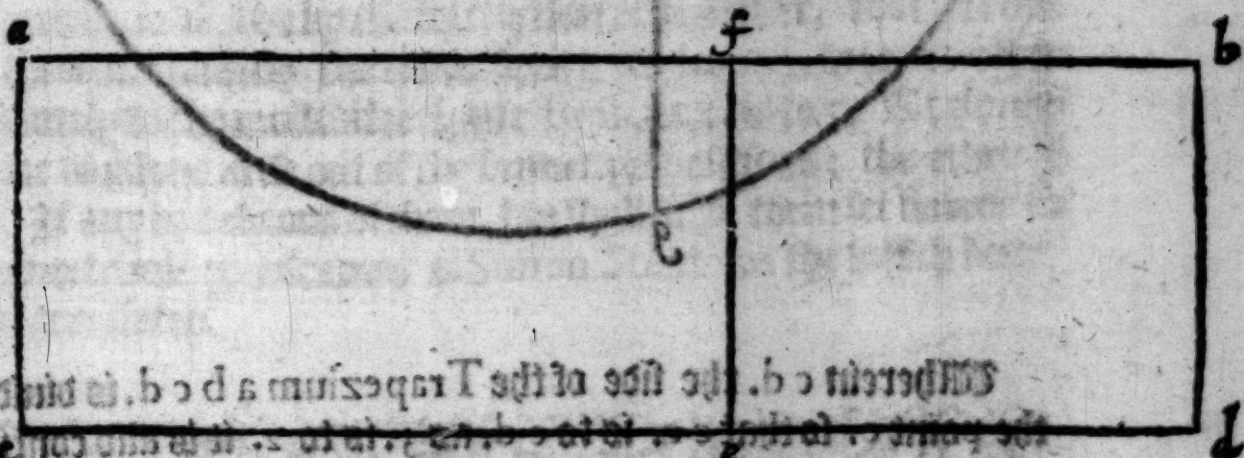
ned: as may be proued by the 6. Proposition of the 7. booke of Ramus in this Demonstration going before.

Triangles of equall height are in proportion as their Bases are. c. l. p. 62

Wherein the Triangle giuen is $a b c$. whose base $b c$. is so cut in the point d . that $b d$. is to $d c$. as 3. is to 2. Therefore the line $a d$. diuideth the Triangle so, that the Triangle $a b d$. is to the Triangle $a d c$. as 3. is to 2.

Againe if the Base of a Parallelogramme be diuided according to a proportion assigned the right line drawn frō the point, where in the diuision was made, perpendicular to the Base shal diuide the Parallelogramme giuen according to the proportion assigned, as may be proued by the 13. Proposition of the 10. booke of Ramus in this Demonstration.

Parallelogramms of equall height are as their Bases l. p. 6.

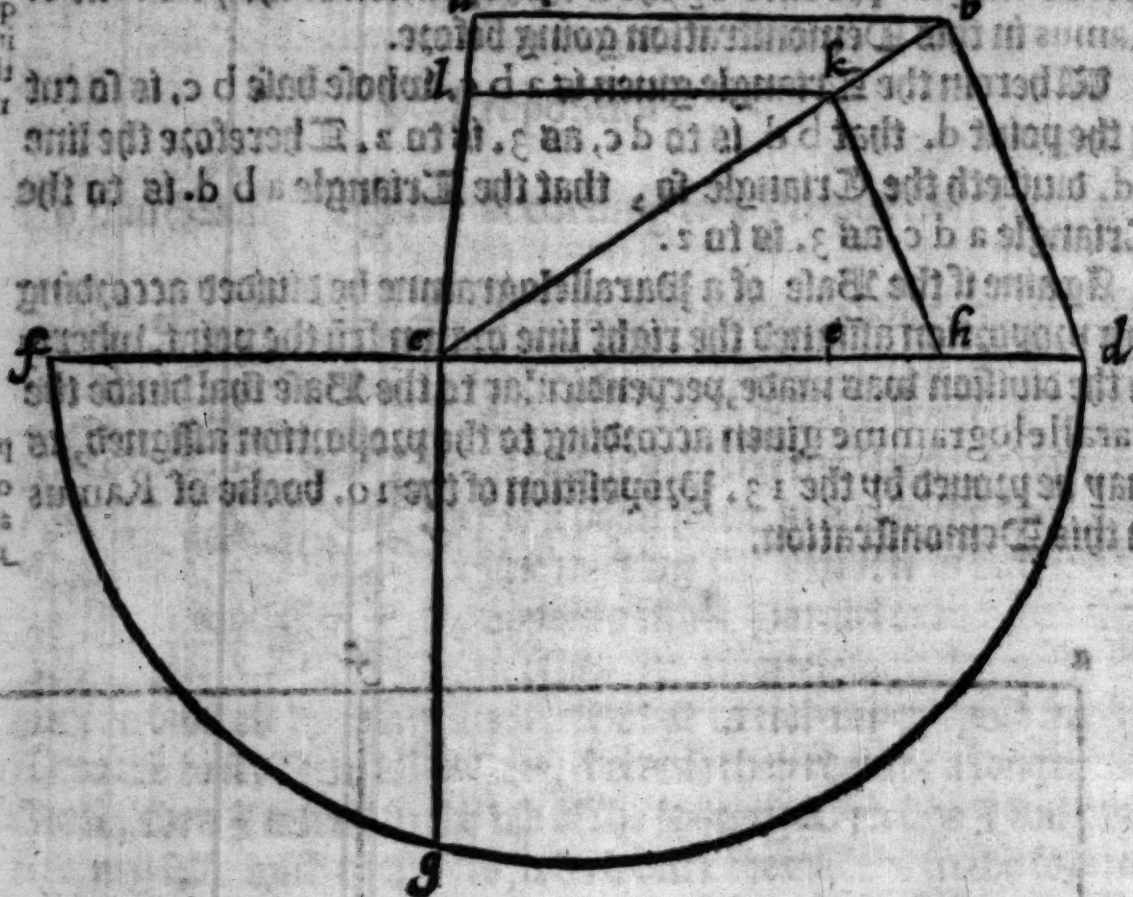


Wherein the Base $c d$. of the Parallelogramme $a b c d$. is so diuided in the point e . that the Segment $c e$. is to the Segment $e d$ as 3. is to 2. therefore the perpendicular $e f$. diuideth the Parallelogramme giuen in the same proportion.

Againe this rule is generall, that if the side of a figure giuen diuided according to a proportion assigned (as hath beene taught in the second Proposition) be continued by the Segment and verable to the first terme of the proportion: and the meane proportionall line betwene the whole side and the continuation be found out by the 3. Proposition: The figure made vpon the said meane proportionall like to the figure giuen and inscribed in it shall diuide it according to the proportion assigned: as may be proued by the first Consecarie of the 15. Proposition of the 4. booke of Ram. in this Demonstration following.

Mentioned before. page 42

The use of the Sector. II



Wherein cd , the side of the Trapezium $abcd$, is divided in the point e , so that ce , is to cd , as 3 , is to 2 . it is also continued out to the point f , according to the length of the line ce , being answerable to the first terme of the proportion: The meane proportionall betwene cd , and cf , is cg , unto which ch , is equall. Wherefore the Trapezium $hklc$, made upon the line ch , like to the Trapezium given $abcd$, and inscribed in it, doth so divide it, that $hklc$, is to the Trapezium given $abcd$, as 2 , is to 3 .

Againe this is generall, that if a lesser figure being made like, and proportional to a greater figure given be inscribed in the greater, it shall divide the greater in such proportion, as the lesser terme of the proportion assigned hath to the remainder of the greater terme: as may be proved by the figures made in the 4. and 6. Proposition of this booke. As for example in the 4. Proposition: The lesser Triangle agh , is to the greater abc , as 2 , is to 3 . The lesser terme of this proportion being taken out of the greater the remainder

remainder is 1. Therefore the lesser triangle being described in the greater diuideth it so, that the one part of it namely the triangle ahg is to the other part of it, namely to the trapezium hbeg as 2. is to one, and contrariwise.

Againe, if a lesser figure being like and proportionall in his sides to a greater figure giuen be inscribed in the greater, it shall diuide the greater in such proportion as the square of the lesser terme of the proportion assigned hath to the remainder of the square of the greater terme: as may be proued by the 8. prop. of this booke: wherein ai. the side of the lesser figure aijklmnop. is to ab. the side of the greater figure abcdefgh. as 2. is to 3. The square of the lesser terme of this proportion is 4. the square of the greater terme is 9. foure being taken from 9. the remainder is 5. Therefore the greater figure is so diuided by the inscription of the lesser, that the one parte thereof, namely the lesser figure aijklmnop. is to the other part namely to the multilater figure biph. as 4. is to 5. These and such like diuisions arise out of the former propositions: the other I omit: If any be desirous of them, hee shall finde them set downe in the geometricall probleames of Simon Steuinius the which booke I haue translated.



Chap. 5. Concerning the vse of the inscriptions made in the nether side or backside of the feet of the Sector.



Thus much concerning the vpper side of the secte, the vse of the nether side followeth. The vse is twofolde according to the inscriptions, which in the first Chapter of this booke were for instruction sake diuided into internal, and external. But first of the internal inscriptions, which are the chordes of circles.

¶ 3

Propositio

The vyle of the Sector .

Proposition 10.

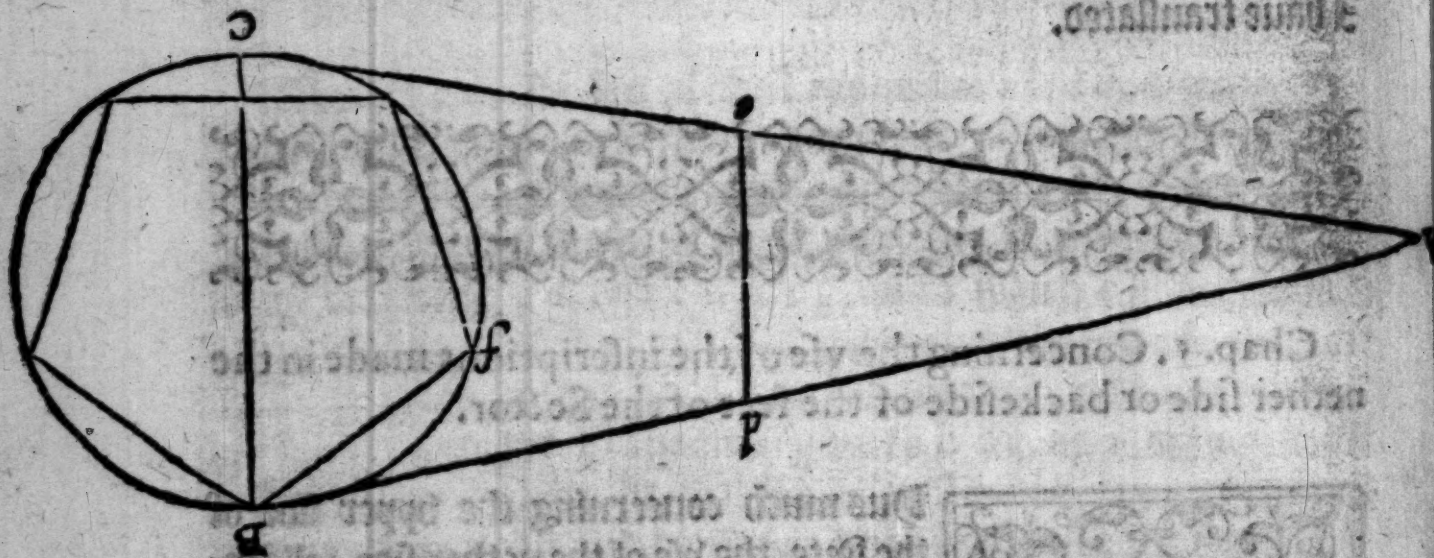
A diameter of a circle being given to find any chorde whose number is inscribed in the feet of the Sector.



Let the line given be the line B C. It is required to find a line, which shall subtende the fift part of that circle, whose diameter is the line B C. Seeke out the number 5. in each foote of the Sector, set the pointes of the sector in the termes of the line given: with your compasses take the distance from 5. to 5. in each foote, that distance shalbe the line which

b. Mentioned before, pag. 9. a.

shal subtend the fift part of the circle made vpon the diameter B C. as may be proued by the 9. p. of the 7. b. of Radius in this demonstration following.



Wherein the line d e. is equall to the line B f. subtending the fift parte of the circle made vpon the line B C. as may bee perceyued by the pentagon inscribed therein. The other chorde are founde out in the same manner.

Propo.



Proposition 11.

Any chorde, whose number is inscribed in the feete of the Sector, being giuen to finde the diameter of that circle, wherein the said chorde may be inscribed.



Let the chorde giuen be the line de . being supposed to subtend the fifth parte of a circle. It is required to finde the diameter of that circle, whose fifth part may be subtended by the line giuen: Seeke out in the feete of the sector the number answerable to the chorde giuen, which in this example is the number 5. With the compasses take the length of the chorde giuen: set the one foote of them

in the left foote of the Sector in the number 5. moue the right foote for so vntill the other foot of the Compasses touch the same number in it. The distance betwene the pointes of the Sector giueth the length of the diameter sought for, as may be proued by the forenamed prop. of Ramus, in the former demonstration.

The diameter is found by the other chordes in the same manner: Out of these propositions arise many consequtaries to bee performed readily by the sector. First this: In a circle giuen the diameter being found it is possible to inscribe an equilater triangle, a square, a pentagon, an Hexagon, an Heptagon, an Octagon, an Enneagon, a Decagon.

Item if from the center of the circle, in which any of the chordes expressed in the feet of the Sector is inscribed, a right line be drawne perpendicular to the saide chorde cutting the circumference in a point at all adventures falling out: The right line drawen from the one end of the chord inscribed to that point shalbe the side of a figure inscribed in the same circle, whose sides shall be in number double to the sides of the figure made of the chorde inscribed, and thus you may proceede infinitely diuiding, and subdividing as you please.

The vse of the Sector.

If the side of an Hexagon be cutte proportionally the greater segment shall bee the side of a decagō.

the 8. prop. of the 18. b. of Ramus in the demonstration following. This may be done otherwise by the Sector, but I content my selfe with this, both to auoide tediousnes, and also because this is the most readie worke.

5 Item a line being giuen for the lesser extreame of a continuall proportion, it is possible by the Sector to finde the meane proportionall, and the greater extreame in this manner. Take the length of the line giuen cb . Set the one foote of the compasses in the left foote of the Sector, in that point which is marked with the number 10. Moue the right foote to and fro, vntill the other foote of the compasses touch the point in that foote marked with the same number. Keepe the foote of the Sector at that extent, and with the compasses take the distance betweene those pointes in the foote of the Sector, which are marked with the figure 6. Then continue out the line cb , so that the continuation ca , may bee equall to the distance taken. I say that the whole line ab , is the greater extreame, and the continuation ac , is the meane proportionall, as may bee proued by the Consectarie of the 8.^a p. of y^e 18. b. and the 1.^b p. of the 14. b. of Ramus.

6 Item a line being giuen for the greater extreame of a continuall proportion, it is possible to find the meane proportionall, and the lesser extreame. This is done easily by diuiding the line giuen by extreame and meane proportion: for then shall the line giuen be the greater extreame, the greater segment shall be the meane proportionall, and the lesser segment shall be the lesser extreame, as may bee proued by the 1. p. of the 14. b. of Ramus.

7 Item it is possible the meane proportionall line being giuen, to find the two extreames in this manner: Take the length of the line giuen ac . Set the one foote of the compasses in the left foote of the sector in that point, which is marked with the figure 6. moue the right foote to and fro, vntill the other foote of the compasses touch the point in that foote marked with the same number. Keepe the foote of the sector at that extent, and with the compasses take the distance betweene those pointes in each foote of the sector, which are marked with the number 10. Then continue out the line giuen ac , so that the continuation cb , may be equall to the distance taken. I say that the whole line ab , made of the line giuen ac , and the continuation

a A right line continued of the side of a Decagon & the side of an Hexagon shall be cut proportionally, & the greater segment shall bee the side of an Hexagon.

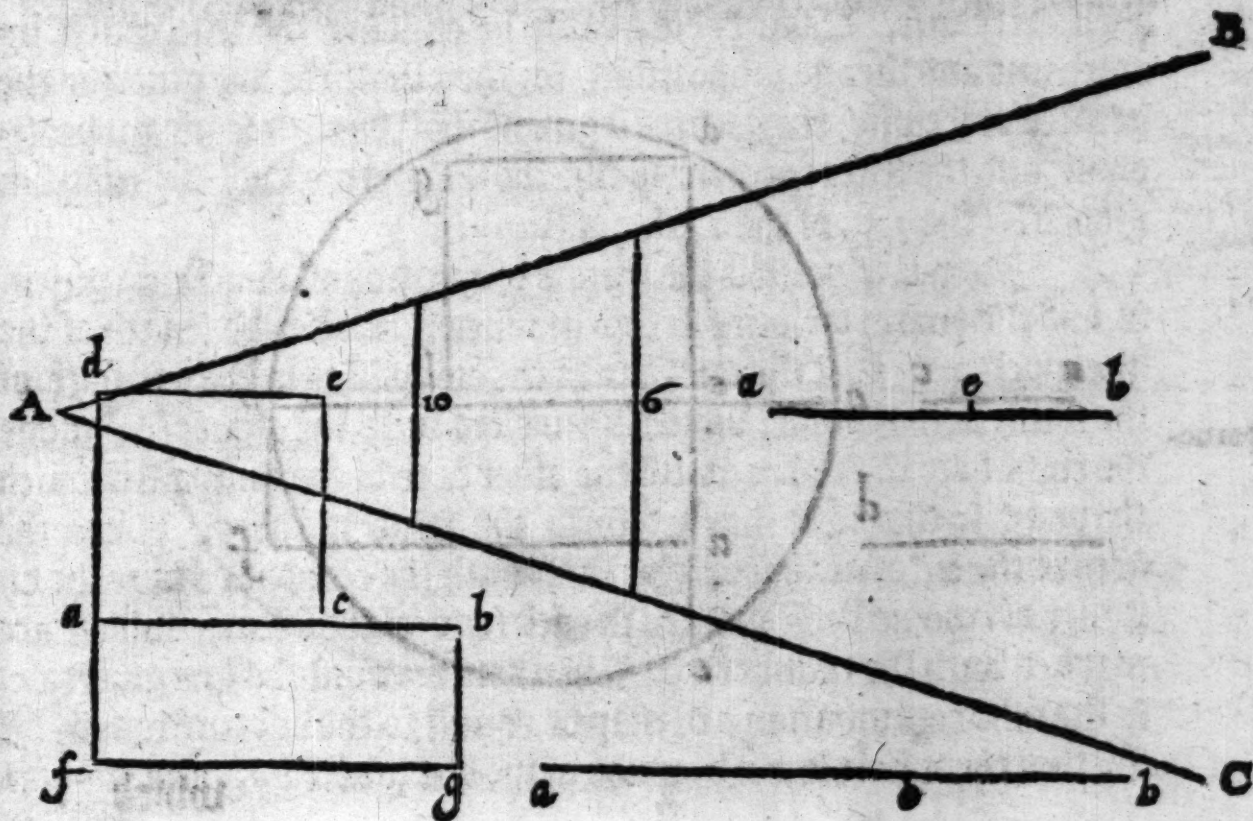
b A right line is saide to bee diuided by an extreame, & meane proportion, when as the whole shall beto the greater segment, so the greater segmente is to the lesser. 3. d. 6

tinuation c b. is the one extreame, and the continuation c b. is the other extreame sought, as may be pꝛoued by the fozenamed proposition of Ramus.

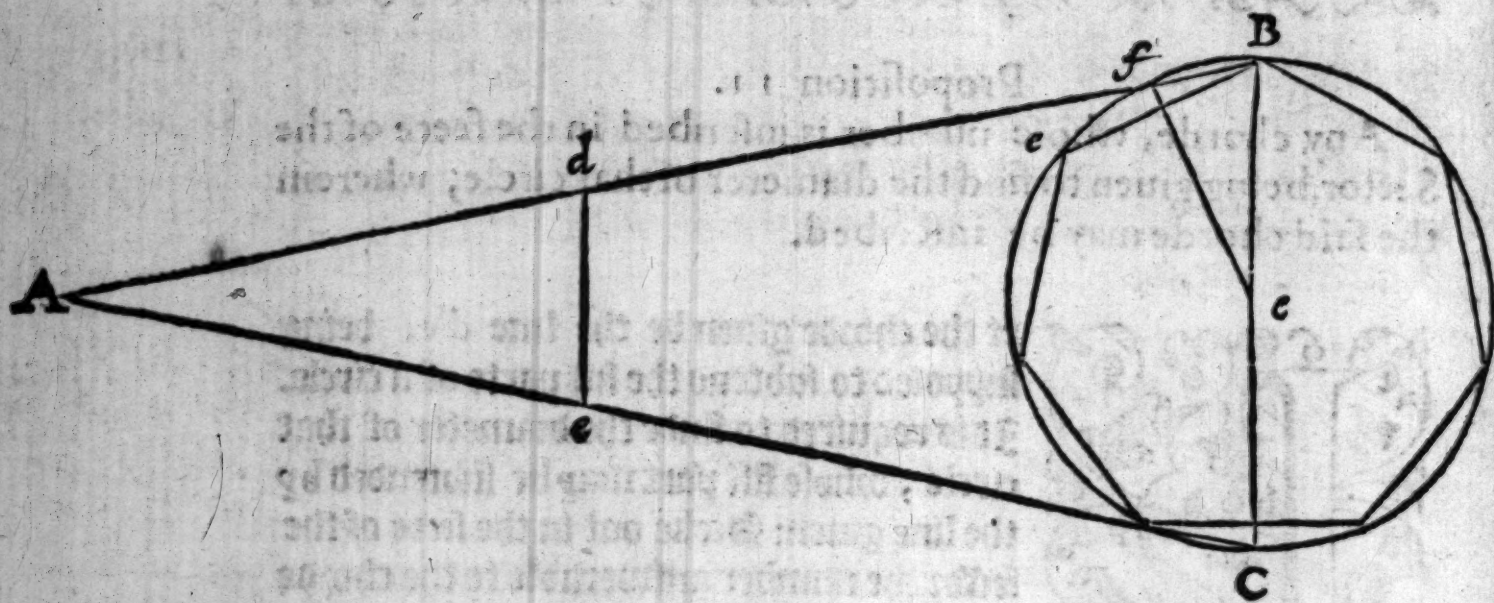
8 And by this meanes also it is possible by the sector, the side of a square being giuen to finde the two sides of an oblonge, which shalbe equall to the square giuen. For the side of the square is the meane proportionall, as may be pꝛoued by the 4. p. of the 12. b. of Ram.

9 And contrariwise either of the sides, or els both the sides of an oblonge being giuen, it is possible to finde the side of a square equall to the oblong. For if one side of the oblonge be giuen, it is either the greater side, which being cut proportionally, the greatest segment shall bee the side of a square sought for, and the lesser segment is the other side of the oblong: or els the side of the oblonge giuen is the lesser side, which is also the lesser segment of a line proportionally cutte, vnto which if you adde the greater segment, as you were taught befoze, the whole line shalbe the greater side of the oblonge, and the said greater segment shalbe the side of the square sought for, as may be pꝛoued by the fozenamed propositions in this demonstration following, which serueth for all the consecutaries from the thirde hitherto.

If three lines be proportionall the square made of the middle line is equal to the right angled parallelogram made of the 2. vtmost lines, & contrariwise. 17. p. 6. & 20. p. 7.



The vse of the Sector.



In this demonstration the chorde Bc. is the side of an Heptagon the line c f. drawn from the Center c. perpendicular to Bc. cutteth the circumference in f. Therefore the line drawn from B the ende of the chorde inscribed to the point f. shall bee the side of a figure ha-
ving 14. sides.

Hereupon it followeth, that by the side of an equilater Triangle being divided and subdivided we may finde out a figure having 6. 12. 24. 48. 96. equall sides, and so forth in that proportion infinitly.

By the sides of a square we may finde out the side of a figure ha-
ving 8. 16. 32. 64. 128. sides &c.

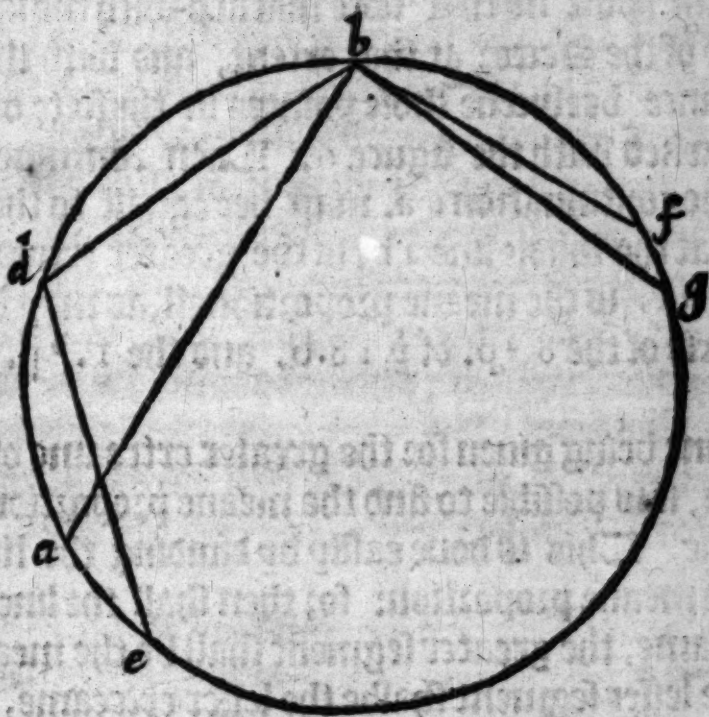
By the side of a Pentagon we may finde out the side of a figure
having 10. 20. 40. 80. 160. sides &c.

By the sides of an Heptagon we may finde out the side of a fi-
gure having 14. 28. 56. 112. sides &c.

By the sides of an Enneagon wee may finde out the side of a fi-
gure having 18. 36. 72. sides &c. Item if in one circle from the
same point b. and on the same side of the circle be inscribed 2. sides
of a Pentagon b d. d e. and one side of an equilater triangle b a. The
line a c. containd betwene the uttermost termes of the saide sides
shall

shall be the side of a Qnindecagon, subtending the 15. part of the whole circumference, as may be proued by the 10. prop. of the 18 b. of Ram. in the demonstration following.

3 Item if in one circle from the same point b. on the same side of the circle be inscribed the side of an Hexagon b f. and the side of a Pentagon b g. The right line f g. contained betwene the ends of those sides shall subtend the 30. part of the circumference, as may be proued by the consecarie of the sozenamed proposition in this demonstration following.



If a triangle, and a pentagon bee inscribed in the same circle at one point the right line inscribed between both their bases opposite to the said point shall be the side of a qnindecagon inscribed 16. p. 4. If a Pentagon & an Hexagon be inscribed in the same circle at the same point, the circumference between both their sides next to the said point shall be the 30 part of the whole circumference.

Item it is possible by the Sector to cut a right line given by extreme and meane proportion in this manner.

Take the length of the line given a b. Set the one foot of the compasses in the left foot of the Sector in the point marked with the figure 6. move the right foot to and fro, untill the other foot of the compasses touch the point in that foot marked with the same figure. Keepe the feet of the Sector at that extente, and then with your Compasses take the distance betwene the pointes in each foot of the Sector marked with 10. count that distance in the line given from a. to c. I say the line a b. is proportionally cut in the point c. and the greater segment thereof is the line a c. as may be proued by

I

the

The vse of the Sector.

If the side of an Hexagon be cutte proportionally the greater segment shall bee the side of a decagon.

the 8. prop. of the 18. b. of Ramus in the demonstration following. This may be done other wise by the Sector, but I content my selfe with this, both to auoide tediousnes, and also because this is the most readie worke.

5 Item a line being giuen for the lesser extreame of a continuall proportion, it is possible by the Sector to finde the meane proportionall, and the greater extreame in this manner. Take the length of the line giuen cb . Set the one foote of the compasses in the left foote of the Sector, in that point which is marked with the number 10. Moue the right foote to and fro, untill the other foote of the compasses touch the point in that foote marked with the same number. Keep the foote of the Sector at that extent, and with the compasses take the distance betweene those pointes in the foote of the Sector, which are marked with the figure 6. Then continue out the line cb , so that the continuation ca , may bee equall to the distance taken. I say that the whole line ab , is the greater extreame, and the continuation ac , is the meane proportionall, as may bee proued by the Consectarie of the 8. ^ap. of γ 18. b. and the 1. ^bp. of the 14. b. of Ramus.

a A right line continued of the side of a Decagon & the side of an Hexagon shall be cut proportionally, & the greater segment shall bee the side of an Hexagon.

b A right line is saide to bee diuided by an extreame, & meane proportion, when as the whole shall beto the greater segment, so the greater segmente is to the lesser. 3. d. 6

6 Item a line being giuen for the greater extreame of a continuall proportion, it is possible to find the meane proportionall, and the lesser extreame. This is done easily by diuiding the line giuen by extreame and meane proportion: for then shall the line giuen be the greater extreame, the greater segment shall be the meane proportionall, and the lesser segment shall be the lesser extreame, as may bee proued by the 1. p. of the 14. b. of Ramus.

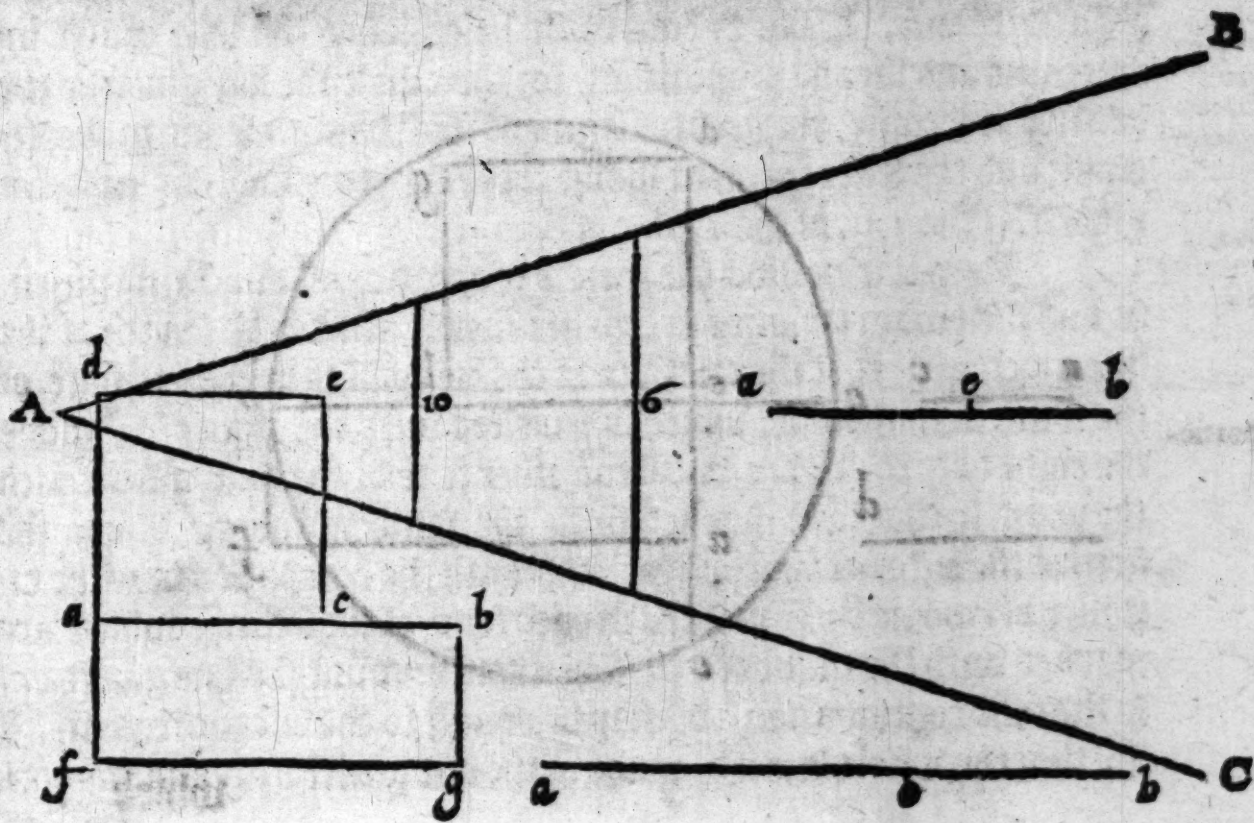
7 Item it is possible the meane proportionall line being giuen, to find the two extreames in this manner: Take the length of the line giuen ac . Set the one foote of the compasses in the left foote of the sector in that point, which is marked with the figure 6. moue the right foote to and fro, untill the other foote of the compasses touch the point in that foote marked with the same number. Keep the foote of the sector at that extent, and with the compasses take the distance betweene those pointes in each foote of the sector, which are marked with the number 10. Then continue out the line giuen ac , so that the continuation cb , may be equall to the distance taken. I say that the whole line ab , made of the line giuen ac , and the continuation

tinuation c b. is the one extreame, and the continuation c b. is the other extreame sought, as may be proued by the forenamed proposition of Ramus.

8 And by this meanes also it is possible by the sector, the side of a square being giuen to finde the two sides of an oblonge, which shalbe equall to the square giuen. For the side of the square is the meane proportionall, as may be proued by the 4. p. of the 12. b. of Ram.

9 And contrariwise either of the sides, or els both the sides of an oblonge being giuen, it is possible to finde the side of a square equall to the oblong. For if one side of the oblonge be giuen, it is either the greater side, which being cut proportionally, the greatest segment shall bee the side of a square sought for, and the lesser segment is the other side of the oblong: or els the side of the oblonge giuen is the lesser side, which is also the lesser segment of a line proportionally cutte, vnto which if you adde the greater segment, as you were taught before, the whole line shalbe the greater side of the oblonge, and the said greater segment shalbe the side of the square sought for, as may be proued by the forenamed propositions in this demonstration following, which serueth for all the consecutaries from the thirde hitherto.

If three lines be proportionall the square made of the middle line is equal to the right angled parallelogram made of the 2. vtmost lines, & contrariwise. 17. p. 6. & 20. p. 7.



The use of the Sector.

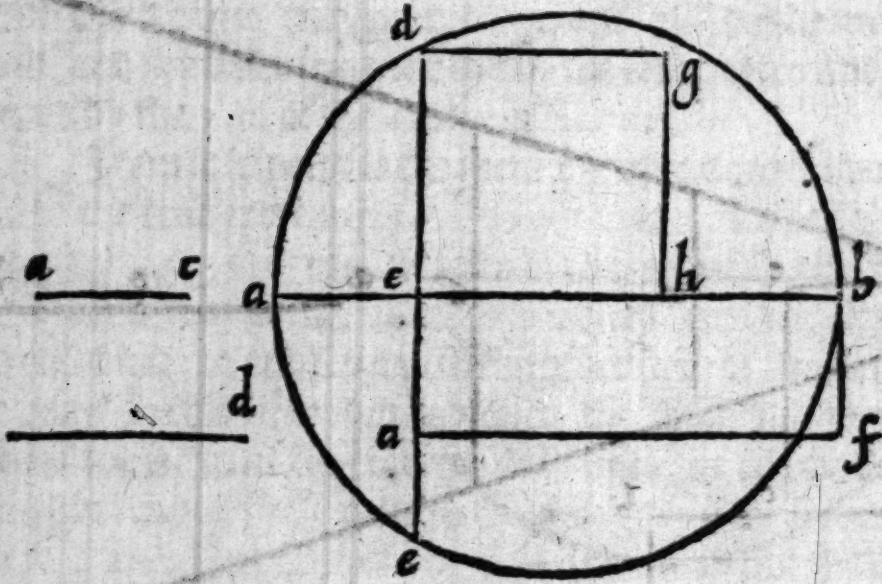
aMencioned be-
fore pag. 13.a.

b Mentioned before pag.27.a,

c If a right lines
inſcribed bee cut
one by the other
the right angled
parallelogramme
made of the ſeg-
ments of the one,
is equal to the
right angled pa-
rallelogra made
of the ſegments
of the other. 35.

p. 3.
d If 2. right lines
do cut at right an
gles into 2. equal
parts 2. right
lines inscribed
the concurse of
the 2. lines ma-
king the equal
partitions shalbe
the center of the
circle. e. 2 5. p. 3.

But if both the sides of an oblong be given, then ioyn them both together in one line, and let that line be the diameter of a circle. From the point whererin they were ioyned together rayse a lyne perpendicular to the diameter, cutting the circumference in a point at all adventures falling out. The length of the perpendicular contained between the diameter, and the circumference shalbe the side of y^e square sought for, as may be proued by the ^a 19. p. of the 16. b. by the ^b 4. p. of the 12. b. & by the ^c 9. p. of the 15. b. of Ra. in this demonstr. following: in which the lines given a c, and c b. are ioyned together in c. and the perpendicular c d. is the side of the square equall to the oblong made of the lines given a c. and c b. Unto these former Consecutaries this may be added, because it is not impertinent to the matter, which we haue in hand, and it may be performed by the sector: One side of an oblonge and the side of a square being given to finde the other side of the oblong in this manner. Continue the side a c. of the oblong given so far as is conuenient, and from the point c. raise a line either perpendicular or oblique to y^e line a c. (for it is at one howsoeuer it be done, but in this demonstr. it is perpendicular) and let it be the line d e. cutting a c. in the point c. From c. vpperward, and downeward to the pointes d. and e. count the side of the square given. Then by the ^d 2. Conf. of the 6. p. of the 15. b. describe a circle,

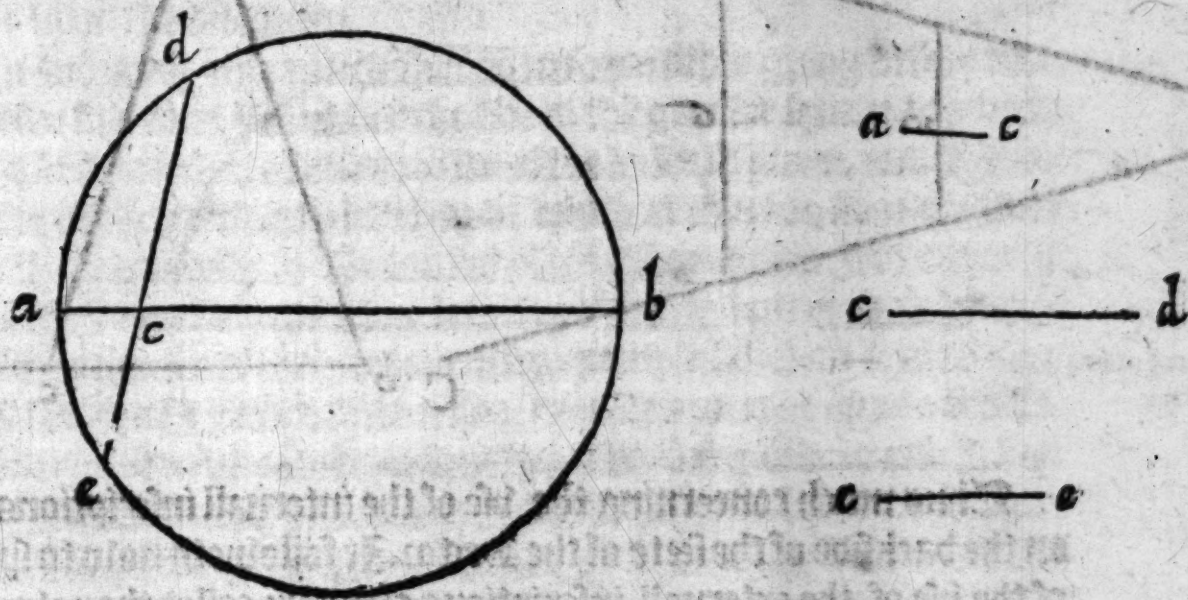


The 2 proportion-
all lines.

which

which may passe through the three points a d e. cutting the line ac. continued out in length in the point b. The line c b. is the side of the oblong sought for as may be proved by the 9. Proposition of the 15. booke of Ramus, in this Demonstration going before.

By this Demonstration I might take occasion (not digressing much from the text, which I haue in hand) to tell you: Two proportionall lines being given how to find the third, because it offereth it selfe in the working of the former Demonstration, and is not pulled in by the eares. Note therefore that if the two lines given a c, and c d. making an Angle be continued out in length the first a c. infinitely, the second c d. equall to it selfe to the pointe e. The right line c b. contained betwene the Angle made by the lines given and the Circumference drawne through a. the beginning of the first line given, and d e. the termes of the second given and continued, shall be the third proportionall sought for, as may bee proved by the Propositions before mentioned. Item three lines being given you shall finde the fourth proportionall line thus: If of the lines given the first a c. and the second c d. making an Angle bee continued out in length: the first a c. infinitely, the second c d. equally to the third c e. The right line c b. contained betwene the Angle made by the two first lines given, & the Circumference passing through a. the beginning of the first line given, and d e. the termes



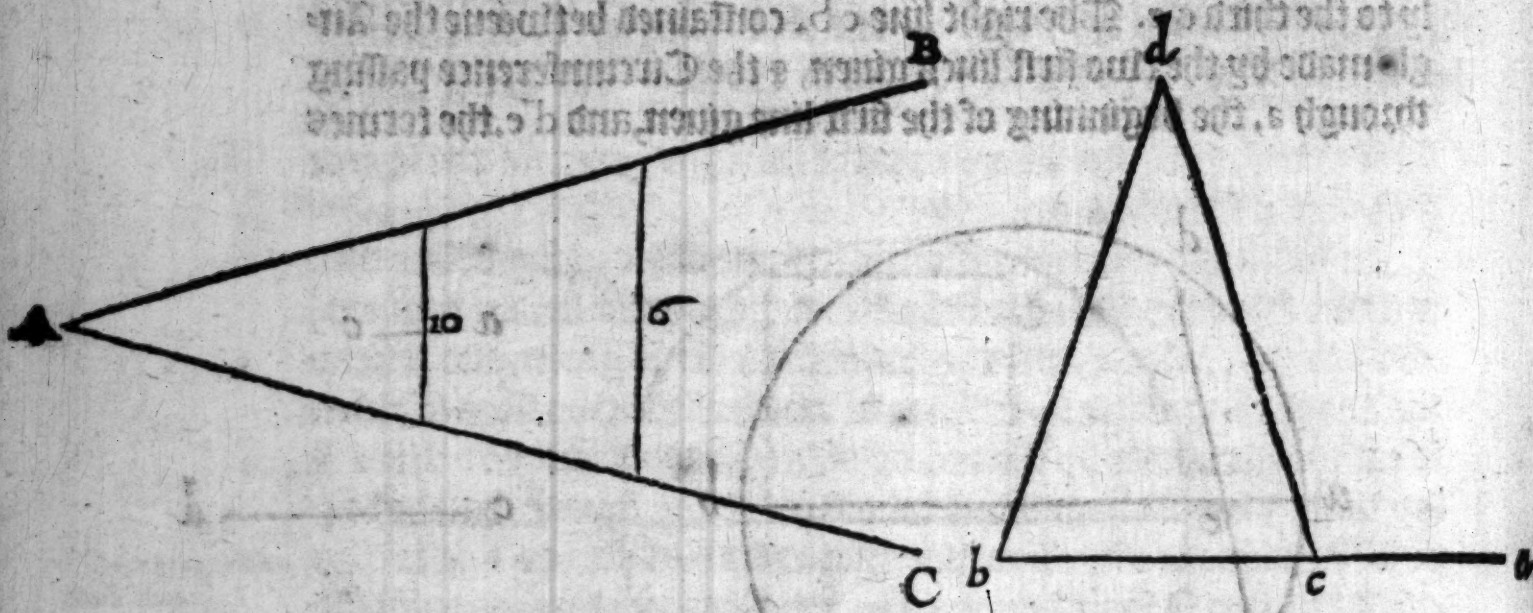
The vse of the Sector.

a If 4. right lines be proportionall, the Parallelogramme made of the two middle lines is equal to the Equiangle Parallelogramme made of the 2. extremes
e. 16 p. 6

c. Mentioned before pag. 27. b. If a right line be divided proportionally, both the Angles of the Triangle, whose feet are equall to the line diuided, and the Base equall to the greater Segmente shall be double at the Base to the Angle remaining
10. 11. p. 4.

of the second, and third given, and continued together, shall bee the fourth proportionall sought for: as may be proued by the 1. Consectarie of the 14. Proposition of the 10. booke, and the 9. Proposition of the 15. booke of Ramus in this Demonstration going before.

To conclude vpon a line given it is possible by the Sector to make a Triangle, whose seuerall Angles at the Base shall bee double to the Angle remaining: For if the line c b. counted in the feet of the Sector between the points marked with the figure 6. as you were taught before in the 6. Consectarie be continued out in length to the point a. according to the distance taken betwene the feet of the Sector (kept at their first extent) in the points marked with the number 10. The Triangle c d b. made vpon c b. the line given, hauing for his feet the whole line a b. made of the line given, c b. and the continuation c a. shall haue at the Base each seuerall Angle a. and b. double to d. the Angle remaining, as may be proued by the 3. Proposition of the 18. booke of Ramus in this Demonstration following.



Thus much concerning the vse of the internall inscriptions set on the backside of the feet of the Sector. It followeth now to speak of the vse of the externall inscriptions commonly called the power of lines marked with the numbers set down after the maner of fractions thus $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$, &c. Their vse is exprest in 2 propositions following.

A line

Proposition 12.

A line being giuen to find an other line, whose power shall be to the power of the line giuen in any such proportion as is expresse in the feete of the Sector.



The proportions set vpon the feete of the Sector are seauen in number, namely the proportion of 1. to 2. of 1. to 3. of 1. to 4. of 1. to 5. of 1. to 6. of 1. to 7. of 1. to 8. or contrariwise of 2. to 1. of 3. to 1. and so forth in the rest: So that it is possible by y^e Sector a line being giuen to find a line, whose square shall be to the square made vpon the line giuen subduple, subtriple, subquadruple, subquintuple, subsextuple, subseptuple, or suboctuple, that is to say it shall be the halfe the third, the fourth, the fift, the sixt, the seuenth, or the eight part of the said square: as shall be thought conuenient for vse. Or contrariwise the square made vpon the line found out shall be to the square made vpon the line giuen double, treple, quadruple, quintuple, sextuple, septuple, or octuple, that is to say, it shall bee twice, thrise, foure, fise, six, seuen, or eight times as great as the square made vpon the line giuen.

In working this conclusion as in some other going before there is a two fold case: For either the side of the greater square is giuen, and I seeke a lesser, or else the side of the lesser is giuen, and I seeke the side of the greater square: Now which of the two sides is giuen is easily vnderstande by the words of the Proposition: For either I say thus: I would haue a line whose power, or square shall be to y^e power, or square of the line giuen (for example sake) as 1 is to 3. or else I say, that I would finde a line, whose power, or square should be subtriple to the power, or square of the line giuen: or else I say thus, I would haue a line, whose power, or square should be y^e third part of the power, or square of the line giue. In all these speeches I am to vnderstand, that the side of the greater square is giuen, & I seeke the side of the lesser, which shall be to the greater square in such proportion as is assigned: Againe if I say thus, I would haue a line, whose power,

The vse of the Sector.

or square shall be to the power, or square of the line given (for example sake) as 3. is to 1. or if I say, that I would haue a line, whose power, or square should be triple to the power, or square of the line given, or if I say, that I would haue a line, whose power, or square should be three times as great, as the power, or square of the line given, I am to conceiue, that the side of the lesser square is given, and the side of the greater is sought for: The manner of finding either the greater, or the lesser is as followeth: Let the line given be a b. and let the proportion assigned be the proportion of 1. to 3. It is required, that I should find a line whose power, or square should be to the power or square of the line given as 1. is to 3. Heere I perceiue that the lesser line is sought for: First therefore I open the feete of the Sector according to the distance of the line given by setting the points thereof in the termes of the line given. Then in each foote of the Sector I seeke out the numbers of the proportion assigned set downe thus $\frac{1}{3}$ and setting the one foote of the Compasses in the point marked with those numbers in the left foote I stretch the other forth to the other pointe marked with the same numbers in the right foote, the distance betwene the feete of the Compasses kept at that extent is the length of the line sought for, namely the line c d. whose square shall be the third part of the square made vpon the line given, as may bee proued by the manner of inscribing those inscriptions, and by the 14. Proposition of the fourth booke of Ramus in the Demonstration following. But if the lesser line bee given, and the greater be sought for, you must worke other wise, as in this example: Let the line given bee c d. and let the proportion assigned be the proportion of 3. to 1. It is required to finde a line, whose power, or square should be to the power, or square of the line given as 3. is to 1. First seeke out in each foote of the Sector the numbers of the proportion assigned set downe thus $\frac{1}{3}$. Then with the Compasses take the length of the line given, and setting one foot of them in the left foote marked with those numbers, moue the right foote to and fro, until the other foote of the Compasses touch the point marked with the same numbers in that foote. The distance betwene the feete of the Sector kept at that extente is the length of the line sought for, namely the line B C. whose square shall be three times as great, as the square made vpon the line given

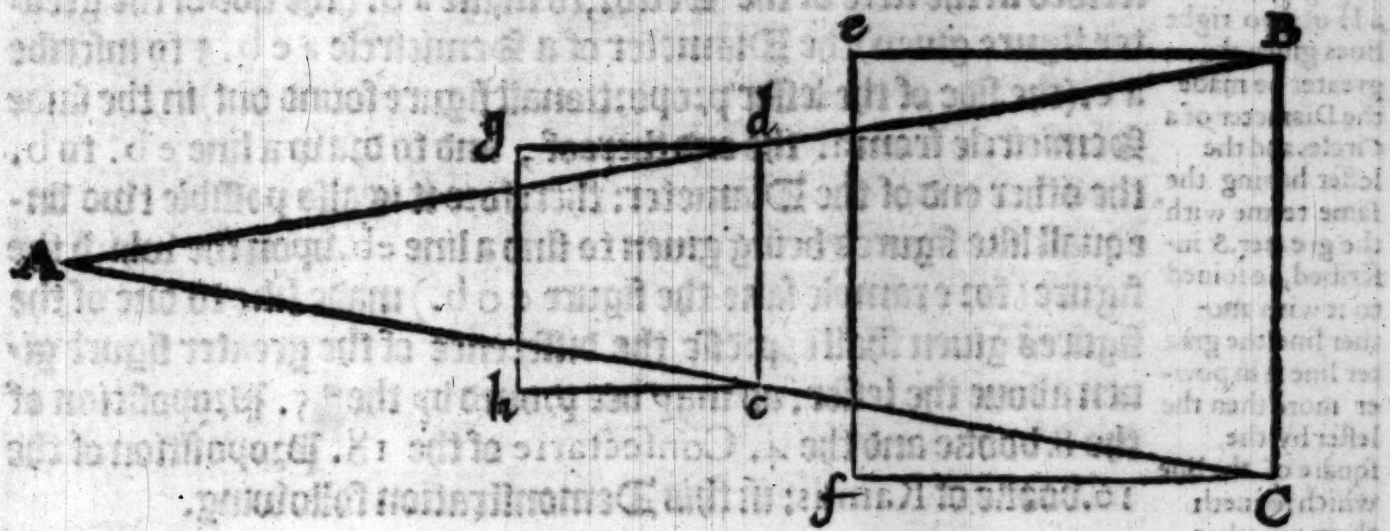
Mentioned before pag. 14. a.

The vse of the Sector.

30

then as may be proued by the forenamed Proposition: and by the 9 Proposition of the 7. b. of Ra. in this Demonstration following.

Mentioned before pag. 9. a.



Here note, that for so much as it is possible for the longer of the lines given, or found out to be the base of a right Angled Triangle (and consequently the Diameter of a Semicircle) And the lesser of them to be the one foote of the said Triangle, and to be inscribed in the said Semicircle, from the one end of the Diameter: Therefore it is possible by the inscriptions made in the secte of the Sector to find out not onely squares, but generally any kind of right lined figures, which shal haue such proportion one to an other as those inscriptions do import, so that they be like one to an other, as may be proued by the 5. Proposition of the 8. booke of Ra. One example will make this plaine. In the last Demonstration going before it is possible for the line a b. to be the Base of a right angled Triangle a e b. or the Diameter of the Semicircle a e b. It is possible also for the line c d. to be the one foote of the same Triangle, and to be inscribed in the Semicircle a e b. from a. the end of the Diameter. Therefore I say, that what right lined figure is made vpon the line a c d. it shall be to the like figure made vpon the line a b. as 1. is to 3. as may be seene in the Demonstration following. In which the Triangle a e k. is to the like Triangle a e b. and the Pentagon a e l m n. is to the like pentagon a b h g f. as 1. is to 3. The like is to be done in the other proportions inscribed in the secte of the Sector.

If the Base of a Triangle doe subtend a right Angle, the right lined figure made vpon the Base is equall to the right lined figures like, & in like manner situated vpon the feete.
a Which in the Demonstration following is the line a c.

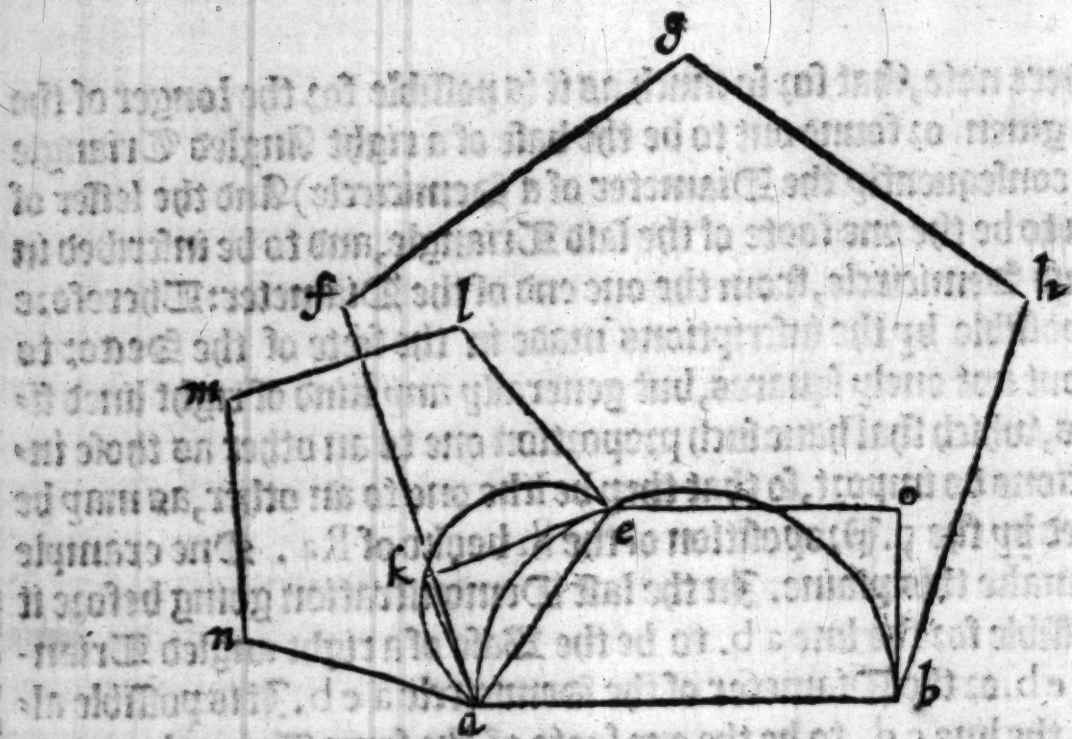
¶

Item

The vse of the Sector.

Mentioned be-
be pag. 30. a.
a l^t of two right
lines giuen the
greater be made
the Diameter of a
Circle, and the
lesser hauing the
same terme with
the greater, & in-
scribed, be ioined
to it with ano-
ther line, the grea-
ter line is in pow-
er more then the
lesser by the
square of the line
which ioyneth
them together
13.p.6.

Item for so much as it is possible two vnequall like figures being giuen (as in the forenamed Demonstration the triangles acb. and a b d) hauing a knowne proportion one to an other as is inscribed in the scete of the Sector, to make a b. (the side of the greater figure giuen) the Diameter of a Semicircle a c b. & to inscribe a c. (the side of the lesser proportionall figure found out) in the saide Semicircle from a. the end thereof, and to draw a line c b. to b. the other end of the Diameter: therefore it is also possible two vnequall like figures being giuen to find a line c b. vpon the which the figure (for example sake the figure e o b.) made like to one of the figures giuen shall expresse the difference of the greater figure giuen aboue the lesser, as may bee proued by the 5. Proposition of the 8. booke and the 4. Consectarie of the 18. Proposition of the 16. booke of Ramus: in this Demonstration following.



And for so much as the figures made vpon a b. the Diameter of the Semicircle and vpon a c. the line inscribed, haue a known proportion one to an other expessed in the scete of the Sector. Therefore it is possible Arithmetically to find the proportion also of that figure, which is made vpon the line c b. drawne from c. the ende of the line inscribed to b. the other end of the Diameter of the Circle

In this manner. Take the lesser terme of the proportion (which is alwaies an unitie as you may easily gather by the numbers inscribed in the scete of the Sector;) from the greater, and compare the remainder with the greater terme: the figure made vppon cb , shall bee to the figure made vppon ab , as the remainder is to the greater terme, and contrariwise: But the figure made vpon cb , shall bee to the figure made vpon ac , as the said remainder is to an unitie. As in the former example the figure ack , is to the figure acb , as 1. is to 3. One being taken out of 3. the remainder is 2. Therefore the figure cbo , shall be to the figure acb , as 2. is to 3. and contrariwise. But the figure cbo , shall be to ack , as 2. is to 1. So that following the inscriptions made in the scete of the Sector, it is possible to make a figure, which shall be to an other figure given as 1. is to 2. and as 1. is to 1. and contrariwise.

Item as 1. to 3. or as 2. to 3. or as 2. to 1. and contrariwise.

Item as 1. to 4. or as 3. to 4. or as 3. to 1. and contrariwise.

Item as 1. to 5. or as 4. to 5. or as 4. to 1. and contrariwise.

Item as 1. to 6. or as 5. to 6. or as 5. to 1. and contrariwise.

Item as 1. to 7. or as 6. to 7. or as 6. to 1. and contrariwise.

Item as 1. to 8. or as 7. to 8. or as 7. to 1. and contrariwise.

Moreover seeing that Circles are in such proportion one to another as the squares made vpon their Diameters, as may be proved by the 2. Proposition of the 15. booke of Ramus: Therefore we may by the scete of the Sector find Circles hauing such proportion one to another as is aforesaid.

Last of all it is possible, a right line being given for the Arletrée of the Spheare to find out the severall sides of the fine ordinate, or regulare bodies to be inscribed in the same Spheare in this manner following.

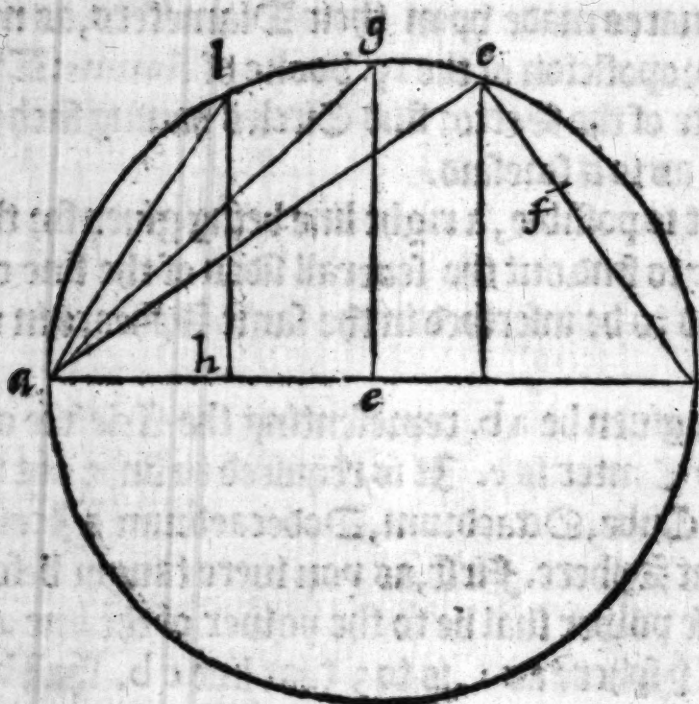
Let the line giuen be ab . representing the Arletrée of γ Spheare $acbd$. whose Center is c . It is required to finde out the side of a Tetraedrum, Cube, Octaedrum, Dodecaedrum, & Icosaedrum to be inscribed in that Spheare. First, as you were taught before, find out a line cb . whose power shall be to the power of the line ab , which is the Arletrée of γ Spheare as 1. is to 3. that line cb . shall be the side of

The vse of the Sector.

a The Diagonall line of the Cube is in power triple to the side.
b If the side of a Cube be diuided proportionally, the greater Segment shall be the side of a Dodecaedrum.

c The Diagonall line of an Octaedrum is in power double to the side thereof.

the Cube sought for, as may be proued by the ^a3. Proposition of the 24. booke of Ra. Cut the side of the Cube by the extreame & meane proportion in the point f. The greater Segment b f. shall bee the side of the Dodecaedron, as may be proued by the ^b15. Proposition of the 25. booke of Ra. Againe inscribe the side of the Cube c b. in the Circle a c b. from b. the end of the Diameter, and from c. to a. draw a right line: the line c a. shall be the side of a Tetraedrum, because it is Subsesquialter to the Diameter a b. as may be proued by the 13. Proposition of the 22. booke of Ra. Againe finde out a line by the Sector whose power may bee Subduple as 1. is to 2. to the power of the line a b. and let it bee the line a g. That line shall be the side of an Octaedrum, as may be proued by the ^c1. Consecaric of the 7. Proposition of the 15. booke of Ramus: Last of all diuide the Semidiameter a c. in the point h. by proportion (as you were taught before) so, that the power of the whole line a c. may be Quintuple to the power of the lesser Segmente c h. and let the greater Segment a h. be next to the ende of the Semidiameter a. and from h. raise a line h l. perpendicular to a b. cutting the Circumference in l. the right line drawne from a. to l. shall be the side of an Icosaedrum, as may be proued by the 9. Proposition of the 26. booke of Ramus in this Demonstration following.



Thus much concerning the vse of the feete of the Sector alone by themselves, it followeth now to speake of their vse with the other partes.

Chap. 6.

Concerning the vse of the feete of the Sector, with the other partes thereof.



The first consideration, which offereth it selfe, is to see what vse the feete of the Sector haue with the circumferential Limbe, regarde being had to the inscriptions made both on the vpper, and nether side thereof. If the right foot of the Sector be applied to the 90. degree of the circumferential Limbe, it maketh a right angle with the left foot, and is perpendicular

unto it. Therefore the sector may be vused as a squire, whereby wee may both draw a line perpendicular to a line giuen, & also trie whether one thing standeth perpendicular, & vpright vpon an other yea or no. The manner how to do this is easie, and therefore it needeth not any longer discourse. Item for so much as the gnomon, Index or stile in euery stationarie sunne dyall is eyther parallel to the surface, in which the houre lines are drawn, or maketh an angle therewith not exceeding 90. degrees, and seeing that the right foot of the sector may be set eyther perpendicular to the left foot, and make a right angle, or may be moued from degree to degree of the circumferential Limbe, making an acute angle with the lefte foot of what quantitie soeuer: Therefore the Sector may bee vused in steade of that instrument which in the Gnomonicall arte is commonly called a Rectificatorium, whereby wee may trie whether the stile standeth in the diall as it should do, yea or no, in this manner. If the stile be, or ought to be parallel to the surface, wherein the dial is made (as in truth it must be in euery surface, wherein it is possible to draw a line parallel to the arctique of the world) then opening the

The vse of the Sector.

sete of the Sector so, that they may make a right angle, and be perpendicular one to another, apply the left foote close to the surface at the roote of the stile, and the right foot to the edge of the stile, which must giue the shadowe to the houre lines, and in that foote make a marke euen with the edge of the stile, draw the left foote along the surface of the dyall from the one end of the stile to the other. If the saide marke made in the right foote bee alwaies euen with the edge of the stile, the stile is parallel to the surface as it ought to be, otherwise it is not, and that is the higher end, which excedeth the marke.

If the stile make an angle with the surface, it is eyther right or acute. The right angle is tryed thus, the sete of the Sector being set perpendicular one to another, as is aforesaid. Apply the left foote of the Sector close to the roote of the stile so, that the edge of the right foote may be euen with the edge of the stile. If their edges agree euery where, then is the stile at right angles with the dyall, otherwise not. The acute angle is tryed thus: Open the feet of the sector so, that they may make such an angle one with another, as the stile in drawing the patterne of the dyall maketh with the stile line. Apply the left foote close to the surface of the dyall, at the roote of the stile, and moue it to and fro vntill the edge of the right foote be euen with the edge of the stile, if their edges agree euery where, then maketh the stile such an angle with the surface as it ought to do, otherwise not. This worke is mechanically, and will not conveniently admit a demonstration, neyther is the demonstration greatly requisite, because the worke is easie, and the words plaine. The profe of the worke is to be taken out of the 9. p. and the Consectarie of the 1. b. of Ramus.

Congruall, or agreeable magnitudes are those whose parts being applied one to another fill an equall place. Therefore congruall magnitudes are equall.

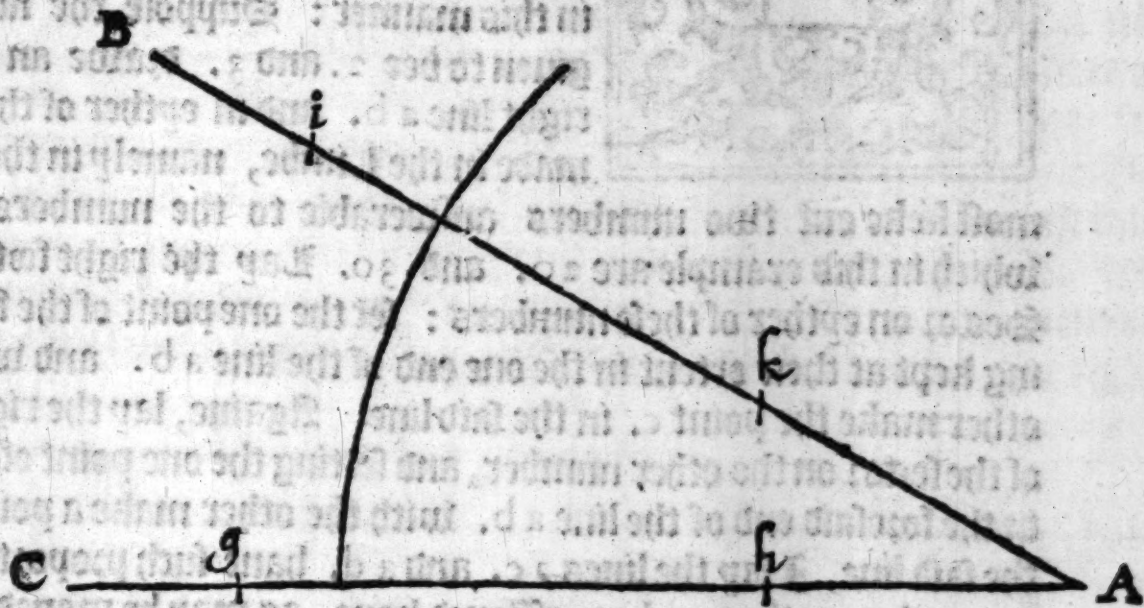
Proposition 13.

The quantitie of an angle being assigned to make an angle according to the quantity assigned.



The quantity of an angle is measured by the arke of a circle contayned betwene the equall feet of the angle, the center of the said arke being in the concurrence of the sete, so that as many degrees of the whole circle as the arke doth containe, so great is the angle saide

said to be. Therefore when the quantity of an angle is assigned, open the saete of the Sector so, that the inner side of the right saete may lie iust vppon the degré expressing the quantity of the angle, which in the demonstration following is 30. degrés. Then lay downe the sector vpon your paper, keeping the saete at their extent, and by the inner side of each saete make two pointes g h. and i k. From g. to h. and from i. to k. draw right lines concurring together, and making an angle at A. which shall be answerable to the quantitie of the angle assigned, as in the figure following.



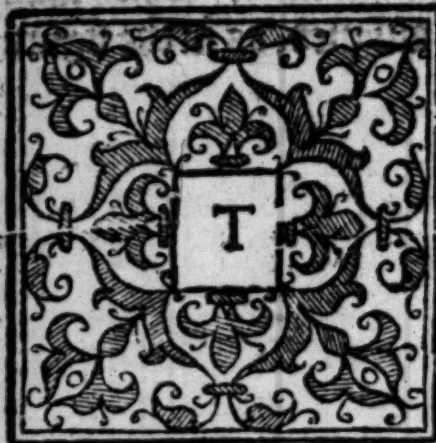
The saete of the Sector, and the circumferential Limbe in regard of the inscriptions made in the vpper side is to be vsed as is aforesaid, but in regarde of the inscriptions made in the nether side thereof, it is to be vsed as the proposition following shall direct you.

Propo

The vse of the Sector.

Proposition 14.

Two numbers or more being giuen, whereof the greatest exceedeth not 150. to finde lines hauing such proportion one to another as the numbers giuen haue.



This was taught in the first proposition of this booke, but here I repeate it again, because it may bee done very readily by the vse of the Sector, and the inscriptions made on the backside of the Limbe in this manner: Suppose the numbers giuen to bee 2. and 3. drawe an infinite right line a b. and in eyther of the scales made in the Limbe, namely in the utter-

most seeke out two numbers answerable to the numbers giuen, which in this example are 20. and 30. Lay the right foot of the Sector on eyther of these numbers: set the one point of the feet being kept at their extent in the one end of the line a b. and with the other make the point c. in the said line. Againe, lay the right foot of the sector on the other number, and setting the one point of the feet in the foresaid end of the line a b. with the other make a point d. in the said line, I say the lines a c. and a d. haue such proportion one to another as the numbers assigned haue, as may be proued by the 9. p. of the 7. b. of Ramus in this demonstration.

^aMentioned before pag. 9. a.

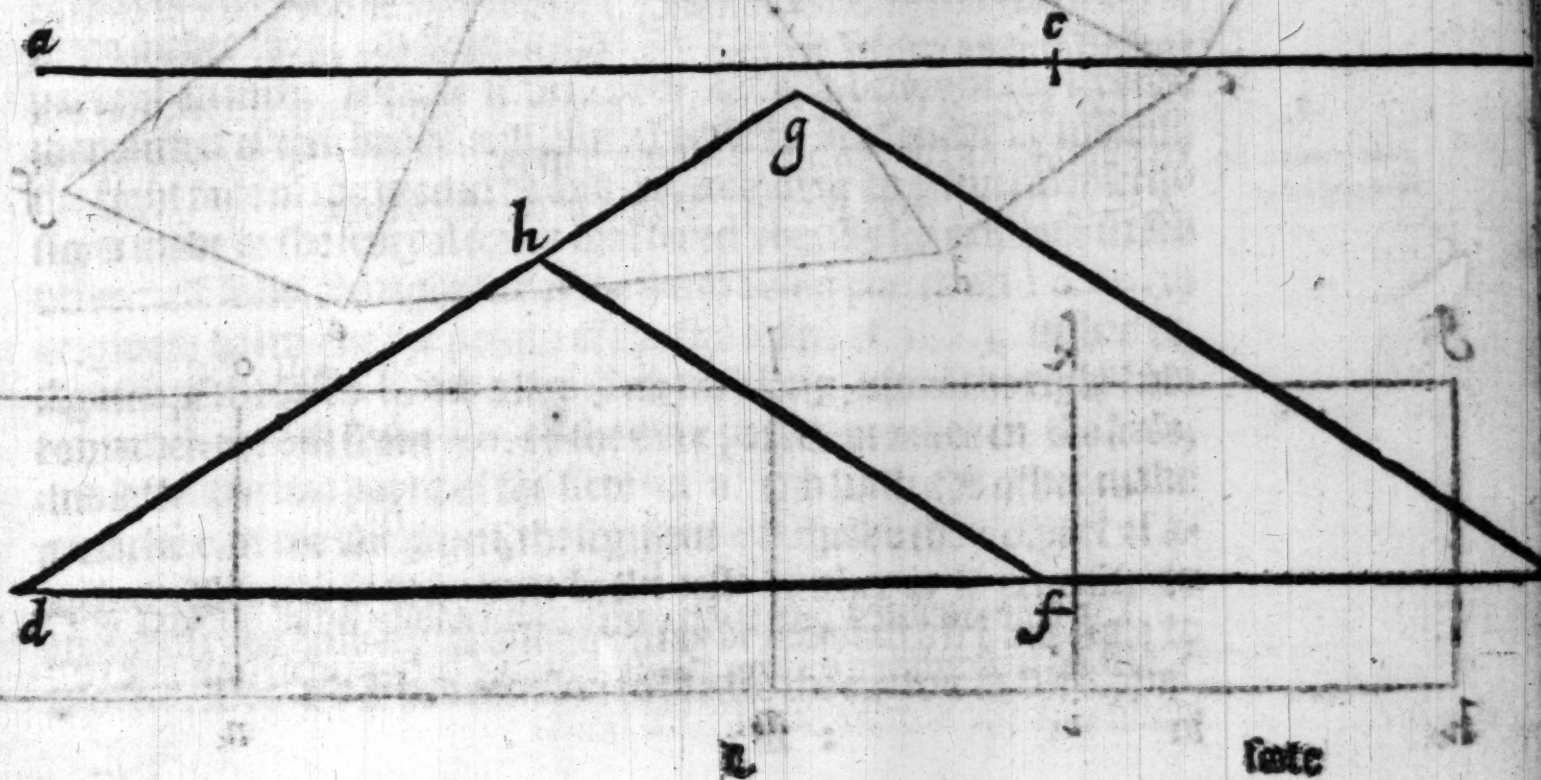
By this meanes you may easily and readily finde out not onely 2, but as many lines as you please, hauing such proportion one to another as the numbers assigned haue.

Propo

Proposition

Two lines being giuen to finde what proportion the one hath to the other.

Let the 2. lines given be a b. and a c. it is required to finde what proportion the one hath to the other: Drawe an infinite line d e. and in that line from d. count the length of the lines given, and let d e. bee equal to a b. and d f. equall to a c. Then set the right foote of the Sector vppon any number of the scale, and keeping the sate at that extent, vpon the line d e. (that is to say vpon the greater of the 2. lines) make an Isosceles d g e. noting well vpon what number the right foote standeth (in making this demonstration I set it vpon 30.) and from f. draw a line f h. parallel to the line c g. cutting the line d g. in h. Extende the pointes of the Sector from d. to h. and note vpon what number the right



The use of the Sector.

the right sorte lighteth (in this demonstration it lighteth on 20.) I say that a b. is to a c. as 30. is to 20. or in lesser tearmes as 3. is to 2. as may be proued by the 8. p. of the 6. b. of Ramus in this demonstration going before.

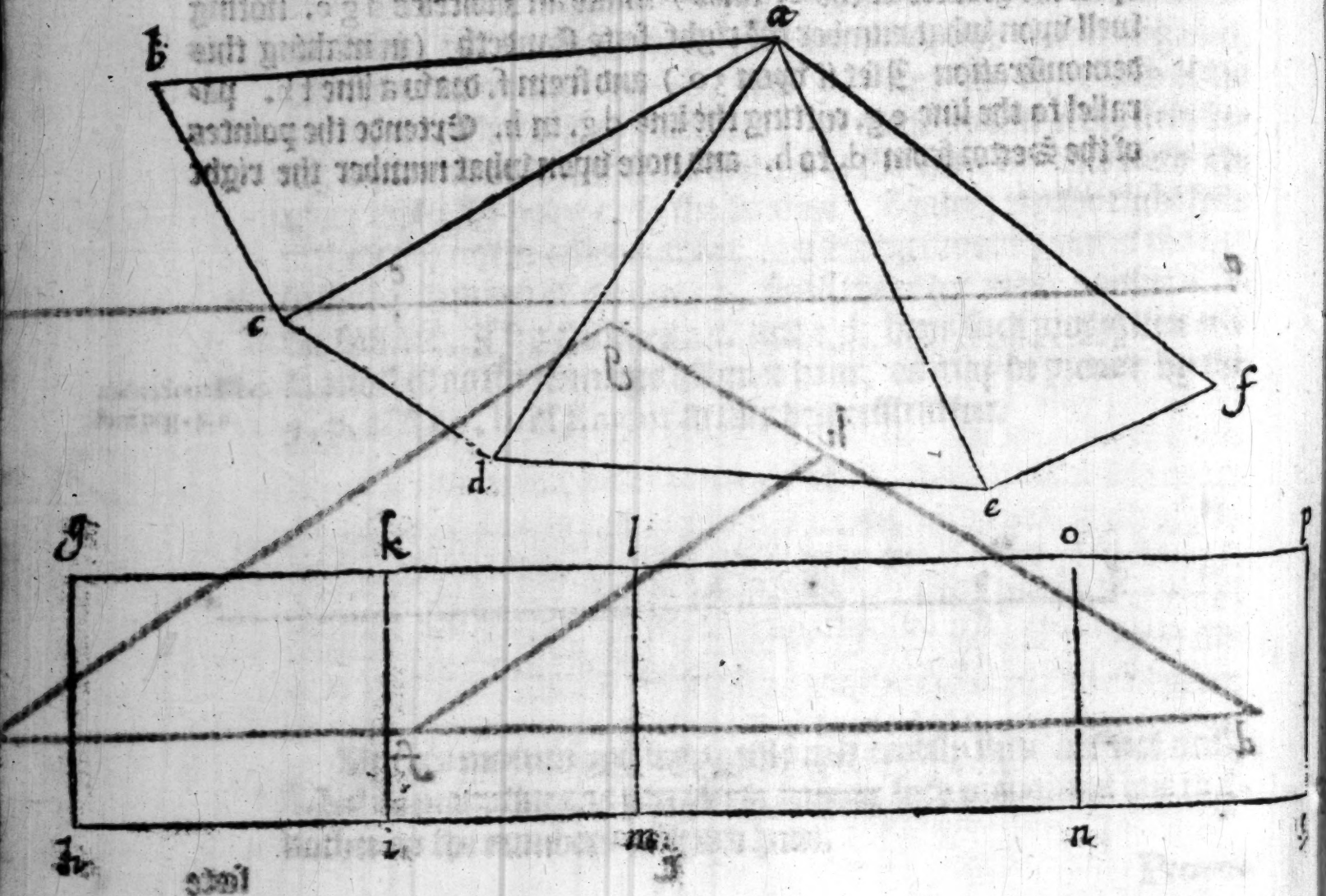
Mentioned before, page 42.

Any 2. sides of a triangle are greater then the third side remainyng. If one complement be made equal to a triangle giuen in a right lined angle giue, the other complement made vp on the right lyne giuen shal bee equall also to the same triangle. 44

P. 30

Here note, that when the right foote of the Sector is set vpon the first number, there must be this proviso had, that the distance betwene the pointes of the s^ecte may bee greater then the halfe of the greatest line giuen, for otherwise the Isosceles dge. cannot be made vpon the line *dc*. as may be proued by the 7. p. of the 6. b. of Ramus.

Item for so much as it is possible to make parallelograms of an equal height equall to the right lined figures given (by the 1. and 2. Consecarie of the 11. p. of the 10. b. of Ramus. Therefore it is possible to finde what proportion one figure given hath to ano-



ther

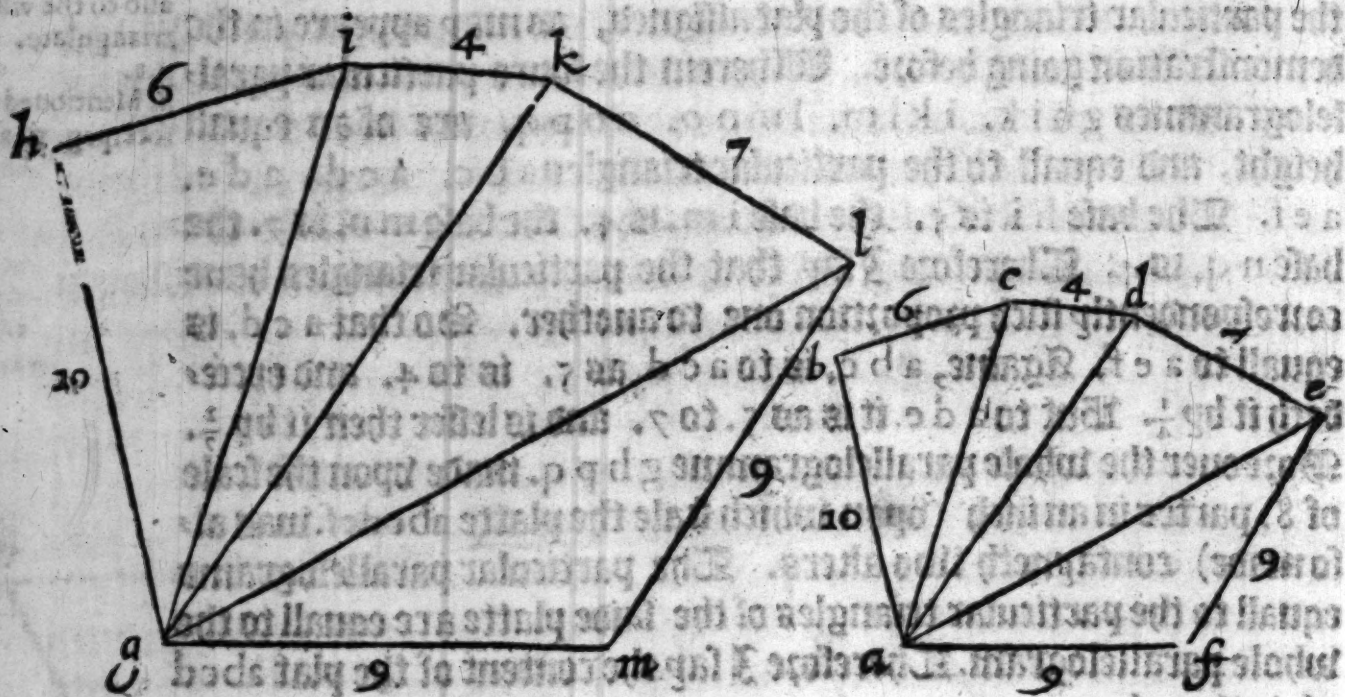
ther, and the excesse of the one aboue the other, as may bee proued by the 13. p. of the 10. b. of Ram.us. It is possible also Geometrically to cast vp the content of an assigned plat of land by making a parallelogramme vpon the same scale, vpon which the plat was made contayning one, 2, or more akers as you shall see conuenient in regarde of the greatnesse of the platte, and by bringing into that parallelogramme certayne particular parallelogrammes equall to the particular triangles of the plat assigned, as may appeare in the demonstration going befoze. Wherein the foure particular parallelogrammes ghik, iklm, lmno, nopq, are of an equall height, and equall to the particular triangles abc, acd, ade, aef. The base hi is 5. the base im is 4. the base mn is 7. the base nq is 4. Therefore I say that the particular triangles haue correspondently such proportion one to another. So that acd is equall to aef. Againe, abc is to acd as 5. is to 4. and exceedeth it by $\frac{1}{4}$. But to ade it is as 5. to 7. and is lesser then it by $\frac{2}{7}$. Moreover the whole parallelogramme gh p q. made vpon the scale of 8. partes in an inch (vpon which scale the platte abcdef. was also made) contayneth two akers. The particular parallelograms equall to the particular triangles of the saide platte are equall to the whole parallelogram. Therefore I say the content of the plat abcd ef. is two akers.

Item if parallelograms bee continually made equall vnto the triangles of a triangulate giuen in a right lined angle giuen, the whole parallelogra shalbe equall also to the whole triangulate. 45. p. 1. a. Mentioned before, pag. 9. a.

I count it needeles here to declare how to giue a line of 1. 2. 3. or more inches long, or how to giue the 20. 105. 16. 8. 4. 2. 12. 6. 3. parte of an inch, because it was both handled befoze in the seconde proposition of this booke, and is most easie to bee founde by mouing the right foote of the Sector to and fro, according as y^e seueral inscriptions made in the seueral scales shal direct you. As for example in the uttermost scale, the right foot of the sector being placed on 10. 20. 30 &c. giueth betwene the points of the feet a line of 1. 2. 3. inches &c. Againe, if the line a b. bee a line of an inch long, moue the right foote towards the left from 10. to the next partition made in the scale, and sette the one poynit of the feete in a. and with the other make a marke c. in the line giuen, the segment c b. shalbe the 20. part of any inch. The like is to be done in the rest: neither is it requisite to admonish you how a plat assigned may be translated fro one scale to another. Because I had occasion to handle the matter in the 8. prop.

The vse of the Sector.

of this book, yet I thought good to adde the demonstration. In which the lesser figure a b c d e f. is made by the scale of 10 perches allowed to an inch, and hath his particular pearches set by each side, the greater is made by the scale of 6. in an inch, and hath also the particular pearches set by each side, so that the proportion of the correspondent sides is one to another as 5. to 3.



Chap. 7.

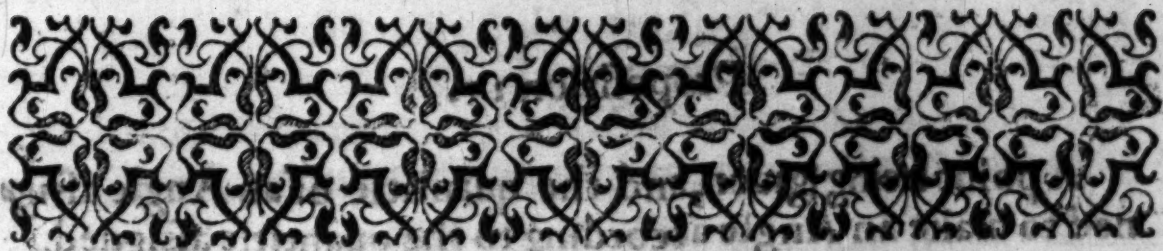
Concerning the vse of the essentiall partes of the Sector, & the accidentall parts ioynly together.



for breuitie sake.

hitherto I haue deliuered the vse of the essentiall partes of the Sector senerally by themselves, and ioynly one with another. It followeth now to declare their vse with the accidental parts, wherein the center pinne, and the center hole first offer themselves, the which in the propositions following I cal simply by the name of the Pinne, and the Center.

Propo.

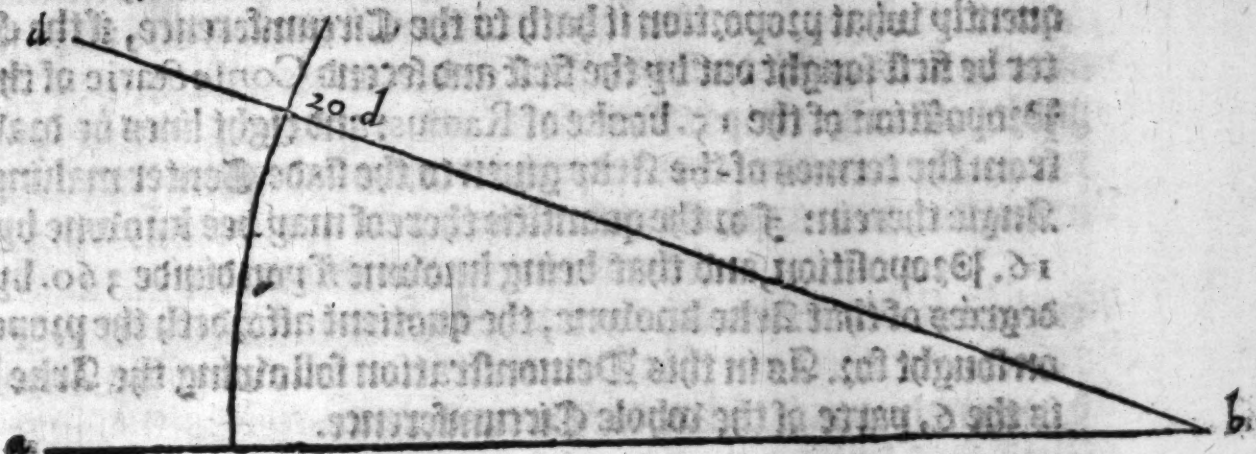


Proposition 16.

An Angle being given to find the quantitie thereof.

That the quantitie of an Angle is, was expressed before in the 13. Proposition: Let the Angle given bee the Angle $a b d$. I desire to know the quantitie thereof. Apply the Center to the round hole made at the toppe of the face of the Sector, and put the pinne into it. Set the pinne in b . the Angle given, and laye the inner side of the left foote of the Sector vpon the line $a b$. staying it fast there so, that neither the pinne may parte from the point a . nor the inner side of the left foote from the line $a b$. Then moue the right foote to and fro, untill the inner side thereof fall iust vpon the line $a d$. The degrees of the Limbe contained betwene the inner side of the face of the Sector expresse the quantitie of the Angle given, as may bee proued by the Consecarie of the 9. Proposition of the 1. booke of Ramus in the Demonstration following.

Congruall, or agreeable magnitudes are equal.



2.

A point

The vse of the Sector.

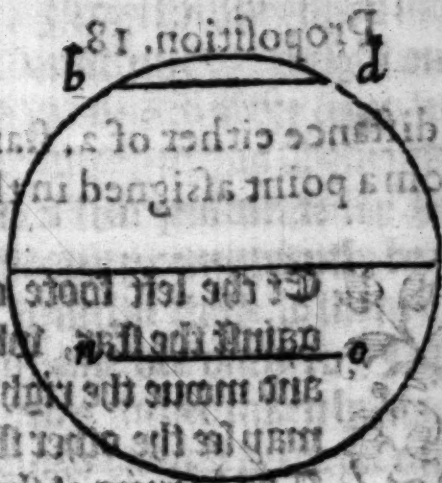
Proposition 17.

A point being giuen, and the quantitie of an Angle assigned to make an Angle according to the quantitie assigned.



Et the point giuen bee a. and let the quantitie of the Angle to be made be 20. d. Set the pinn in the point a. the right foote of the Sector being applyed to the degree assigned, and by the inner side of each foote make a point b. and d. From b. & d. draw right lines to a. Those right lines shall include an Angle at the point giuen equall in quantitie to the Angle assigned. Here note, that if the quantitie of the Angle bee not by number assigned, but Geometrically giuen, then must wee first seeke out the quantitie thereof by the 15. Proposition: and afterward follow the prescript of this Proposition.

By this meanes we may in plotting of a peece of ground protract our Angles very speedily not using any other protractor. Item we may by this meanes at a point giuen vpon a line giuen make an Angle equal to an Angle either Geometrically, or Arithmetically assigned, the which thing hath singular vse in plotting of ground. Item by this meanes an Arke being giuen we may finde howe many degrees of a whole Circle it containeth, and consequently what proportion it hath to the Circumference, if the Center be first sought out by the first and second Consecarie of the 6. Proposition of the 15. booke of Ramus: and right lines be drawne from the termes of the Arke giuen to the said Center making an Angle therein: For the quantitie thereof may bee knowne by the 16. Proposition, and that being knowne if you diuide 360. by the degrees of that Arke knowne, the quotient affordeth the proportion sought for. As in this Demoustration following the Arke b d. is the 6. parte of the whole Circumference.



If you desire to know what proportion the chorde $b d$. hath to the whole Circumference then must you haue recourse to the first and second Proposition of this booke: for by the first & second Proposition: you may find out a line $l m$. which shall haue such proportion to the line $f g$. which is the Diameter of the Circle, as 22. hath to 7. (that is to say as the Circumference hath to the Diameter.) And then by the 15. Proposition you may easily finde what proportion the line $b d$. hath unto the line $l m$. Heereby you may also find out a right line answerable, and equall to any Arke, or Circle assigned. For as the whole Circumference is to the Arke $b d$. so is the whole line $l m$. to the line $n o$.

The former Propositions, as you may perceiue by them, concerne especially such Angles as are made vpon paper, pastboard, or such like as occasion serueth.

The Propositions following concerne the taking of Angles in the open aire according as the obiect doth require: For the taking of these Angles the sights must be applyed to the Sector in such sort as was declared in the 21. Chapter of this booke, and all of them to the three lined staffe belonging to the Sector.

The Angles taken in this manner are either Astronomical, or Geodeticall.

The Astronomical Angles are those, which haue relation to γ stars in taking their distance one from another or else from some point assigned in the heauen, as in γ propositions following may appere.

To

Proposition. 18.

To take the distance either of 2. starres one from another,
or of a starre from a point assigned in the heauen.



Et the left foote of the Sector steadily against the star, which is on your left hand, and moue the right foote to and fro, til you may see the other starre through the sights. The degrees of the Circumferentall Limb intercepted betwene the sights giue the distance sought for. Heere note that if the left foote be set directly against the Sunne, or starre, and the right foote by the helpe of the magneticall Needle be placed North, South, East, or West, as occasion serueth, you shall finde the Azimuth, and the orientall, or occidentall amplitude of the Sunne or starre.

Proposition. 19.

To take the height of the Sunne, Starre, or any thing else seene aboue the Horizon.



In the helpe of a Plummet line set the Sector so, that the edge of the left foot may be paralel to the Horizon: raise the right foote until you may see y^e thing intended through the sights. The degrees of the Limbe intercepted betwene the sights giue the distance sought for: These Propositions haue a singular vse in Astronomicall matters, but it is not my purpose to runne into that discourse. This onely I will touch, and no more, because it is delightfull, and oftentimes sought after of many, The height of the Sunne being giuen to finde the houre of the day. On the left side of this Demonstration in the line A. C. seke out the degree of the elevation,

elevation of the Sunne. From thence runne directly on in a line Paralel to the line A B. untill you come right over the day of the month, or right against the degree of the signe, which the Sunne possesseth. The houre line (which in this Demonstration is a crooked line) next vnto the end of that Paralel is the houre sought for. This Demonstration may very conueniently be grauen vpon the Socket of the Sector, or vpon the staffe, so that you shall not neede to haue recourse vnto this booke, but onely to y^e Instrument it selfe.

The Geodeticall Angles to bee taken by the Sector are such as haue relation to the things viewed heere on earth, in suruaying their altitude, deapth, longitude, or latitude: Herein we are to consider how they are taken, and what vse they haue.

The Angle of the altitude or height, and the Angles of y^e deapth of any thing (which is nothing else but an altitude reuerfed) are taken in the same maner as the altitude of the Sunne, or Starres. They may be taken also although the left foote stand not Paralell to the Horizon, but common experience hath found it most conuenient that it should stand so, in respect that it is the most easie, and speedy way to find the height or deapth of a thing measured. In taking the Longitude of any thing, the left foote must bee sometimes Paralell to the Horizon, and sometimes perpendicular, and the right foote must be moued to, and fro. In taking the Latitude, or distance betweene two marks assigned there is no great heed to be taken, either to the perpendicularitie or parallilitie of the feete to the thing measured, but they are to be placed, as you your selfe shall find it most conuenient.

The vse of these Angles is either in the measuring of the height deapth, length, or breadth of any thing, or else in making the platte of a Suruay, and herein the Angles of Latitude haue most vse, as in the Proposition following shall appeare.

Proposition 20.

A peece of ground being assigned to make the plat therof.

A plat may be made either by measuring from some one place assigned within the ground to each corner, and bought ther-

of,

The vse of the Sector.

of, or by measuring the bowndes thereof, or by the angles of position, as wee commonly terme them, taken at two, or more stations made in two, or more places of the ground. It were tedious to write of them all, and almost needlesse, for by one it may be gathered, what is to be done in the rest. Let the peece of ground assigned be abcdefghi. First at every corner, and bought thereof erect a marke beginning at the left hand, and going towarde the right as you see here at abc. &c. Then place the sector in the midst of the ground, or in some other place, from whence you may well view each corner, and bought, in this demonstration it is placed at l. Set down in your writing tables, or paper for every mark a letter, following the alphabeticall order, and betwixt each two letters place the letter l. on y^e left hande representing y^e place of your instrument: with your surveying line measure y^e number of perches betweenyour instrument, or station, & each mark observing diligently at which marke you begun, and let that marke be called a. and the next to that toward the right hand b. &c. Against each letter answering each severall marke, write the number of perches measured. This done, direct the left foot of the Sector to the first marke a. and keeping it steady leuell the right foot at the second marke b. on the right hand. Note the number of the degrees containned in the Limbe betweene the feet: write that number on your right hand in your tables, betweene the first and second letter against l. Secondly direct the left foot of the Sector to b. the second marke, and keeping it steady leuell the right foot at c. the third marke on the right hand. Note the number of degrees containned in the Limbe betweene the feet, write that number in your tables on your right hand betweene the second, and third letter against l. do thus so often as there are angles, or letters remaining, forgetting not both to note and write the quantitie of each severall angle orderly as they are taken. Then in a peece of paper or pasteboarde, make a point m. and from that point draw a line m. n. in that line from m. to n. count the number of perches measured in the fielde from l. to the first corner a. At the point m. upon the line mn. make an angle nmo. equall to the angle. alb. as you were taught before in the 13 proposition of this booke. Again in the line m o. from m. to o. count the number of perches containned

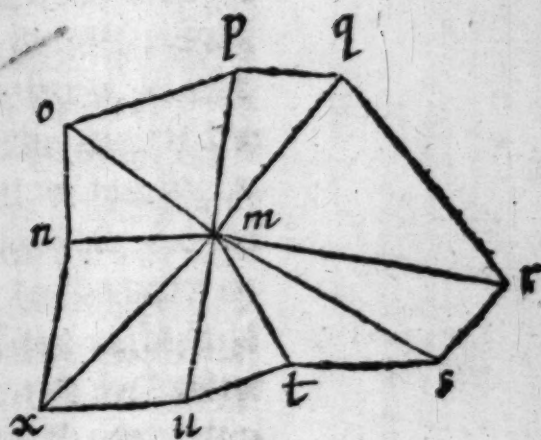
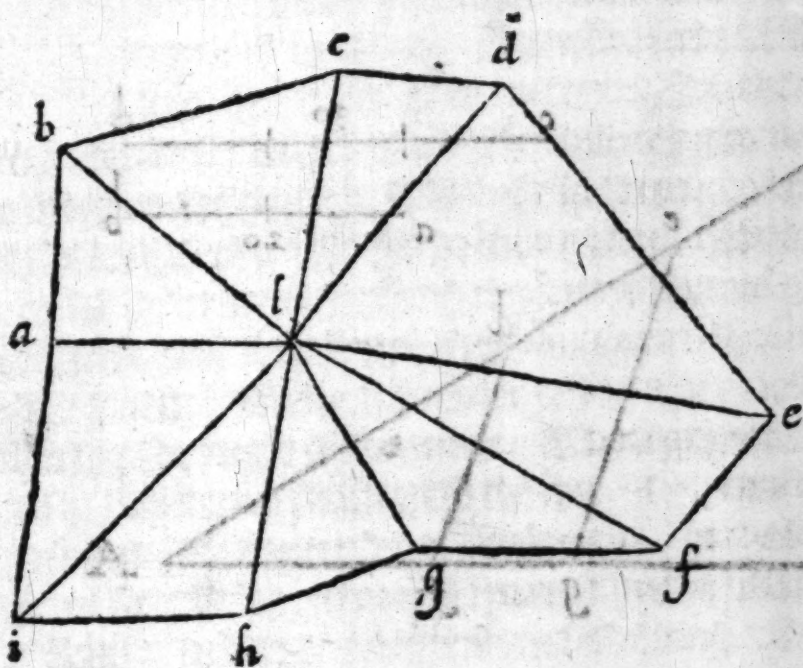
layed in the fielde from l. to b. the second corner toward the right hand, and at the point m. vpon the line m o. place an angle o m p. equall to the angle. b l c. Item in the line. m p. from m. to p. count the number of pearches containned in the fielde betweene l and c the thirde corner, and at the point m. vpon the line m. p. make an angle p m q. equall to the angle c l d. do thus untill you haue made so many angles in your platte, as there were angles in the fi. lde about the point l. Then from n. to o. from o. to p. from p. to q. and so forth successiue, from point to point draw right lines which shall inclose a platte or figure like, that is to say equiangle, and proportionall to the peece of ground assigned, as in the demonstration following may appeare, and may be p.oued by the 4. coniect. of the 14. p. of the 4. b. of Ram.

Mencioned before. pag. 18.2.

pearches. angles

a	8	
b	10	40
c	9	60
d	11	30
e	16	60
f	14	20
g	8	30
h	9	40
i	13	35
a	8	45

Here note, that for limiting out the severall numbers of pearches in each severall line drawne from the point m. there is no fitter instrument then the Sector, because the scales of pearches set on the backe side of the Limbe are ready at hand, and the right foot may easily be moued to and fro from number to number, so that thereby we auoide the manifold trouble of taking up, and laying downe the scale and compasses, which otherwise we should be inforced vnto.



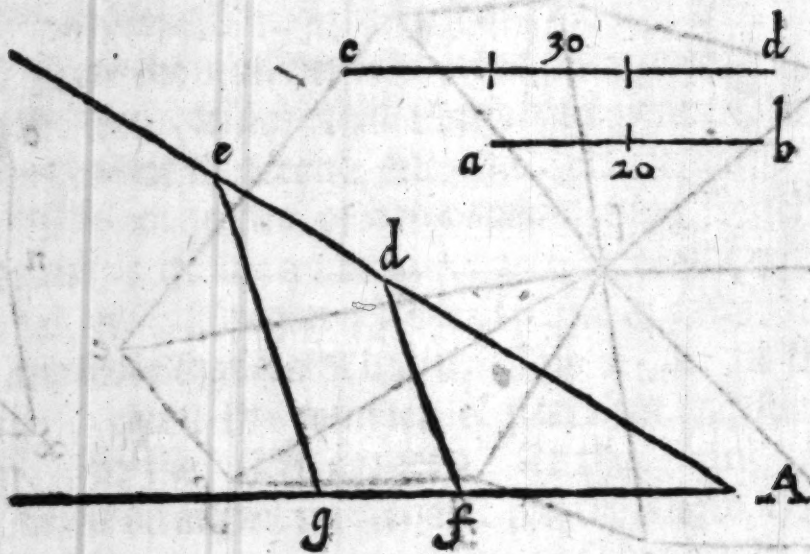
The vse of the Sector.

I willingly omit the other two kindes of plotting any peece of ground assigned, because the thinge is not very harde, and it is to bee found every where set downe in Geometricall pamphlets, besides that being a mechanicall thing it is more tedious to expresse it in words, then in deede to practise. & may bee sooner learned by Demonstration, then deliuered by writing. This is one vse of these Angles, the other vses cannot be wel expressed untill I haue taught you the vse of the Hypotenusall Index. Now this Index shold be applied to the left foote was declared before in the second Chapter, which being obserued, and done according to that prescript it is to be vled as followeth.

Proposition 21.

Two lines, or numbers being assigned in the secte of the Sector to finde the third proportionall terme.

Let the two lines giuen be ab . and cd . Let ab . be 20. and cd . 30. I desire to find a line which shalbe to cd . as cd is to ab . Open the secte of the sector, that they may make an angle BAC . & let them be kept at that extent. Then in the left foote from A . to f . count the length of $a b$. the first line giuen. Set the center of the index vpon the point f . Likewise



The vse of the Sector

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in the right foote from *A*. to *d*. count the length of *c d*. the seconde line giuen: apply the edge of the index to the point *d*. not mouing the center thereof out of his place. Againe from *A* to *g*. in the lefte foote of the Sector count the length of *c d*. the seconde line giuen. Bring the center of the index to the point *g*. not altering the angle which the index made with the left foote. The part of the right foote (which in this example is the line *A e*) containned betweene the index and *A*. the center of the Sector is the thirde proportionall terme sought for, as may be proued by the 12.^a and 13.^b p². of the 5 b. of Ramus in this demonstration following. Here note that the same manner of worke is to be followed in searching out the third proportionall number, as may bee percepued in the same demonstration, for as *A f*. 20. is to *a d*. 30. so is *A g*. that is to say *A d*. 30. to *A e*.

a If right lines cut by a right line be parallel they make the outward angle equal to the inward opposite angle, & contrariwise.
b If right lines be cut by parallel right lines, the segments are proportional e. 2. p. 6. & 17. p. 11.

45.

Proposition 22.

Three lines, or numbers being assigned in the feet of the Sector to finde the fourth proportionall terme.

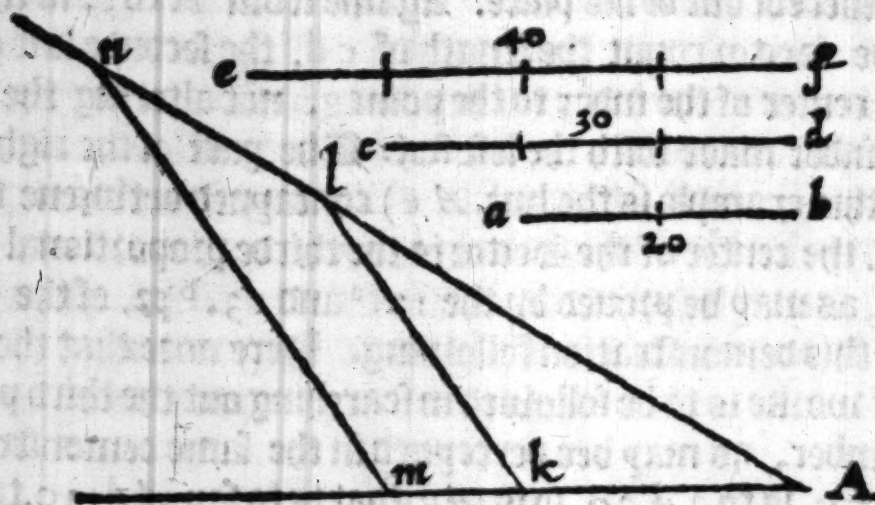


Et the lines giuen be *a b*. 20. *c d*. 30. *e f*. 40. It is required to find a line, which shall be to *e f*. in such proportion as *c d*. is to *a b*. Open the foote of the Sector, and keepe them at their extent: In the left foote from *A*. to *k*. count the length of *a b*. the first line giuen. Set the center of the index on the point *k*. Likewise in the right foote from *A* to *l*. count the length of *e f* the thirde line giuen. Apply the edge of the index to the point *l*. not mouing the center thereof out of his place. Againe, in the left foote from *A*. to *m*. count the length of *c d*. the third line giuen. Bring the center of the index close to the point *m* not altering the angle of the index. The segment of the right foote (which in this demonstration is the line *A n*. containned betweene the index and *A*. the center of the Sector, is the fourth proportionall terme sought for, as may be proued by the forenamed propositions of Ramus in this demonstration following. The like is to be done in searching out the fourth proportionall number.

3

Propo

The vse of the Sector



Proposition 23.

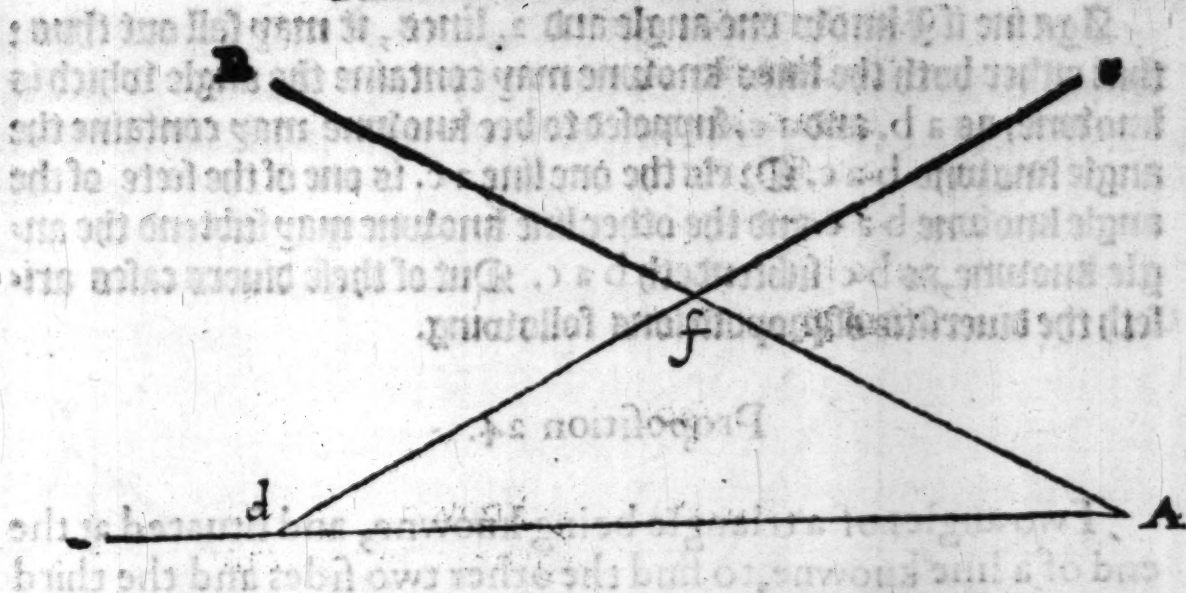
To make an angle at the center of the index equall to the angle made at the center of the Sector.



The angle made at the center of the Sector is containd under the sacte of the Sector *A B.* and *A C.* but the angle made at the center of the index, is the angle containd under the index *d c.* and the position of the left sote containd betwene it and *A.* the center of the Sector. This angle is made equall to the other in this manner. Set the center of the index in a place of the left sote, namely at the point *d.* Open the sacte of the Sector that they may make an angle *B A C.* Move the index to and fro untill it make an Isosceles with the right sote (that is to say untill the partes of the index *d f.* cut of by the right sote, be equall to the partes of the right sote *f A* cut of by the index) then shall the angle *f d A.* at the center of the index bee equall to the angle *f A d.* at the center of the Sector, as may be proved by the 10. p. of the 6. b. of Ramus in this demonstration following.

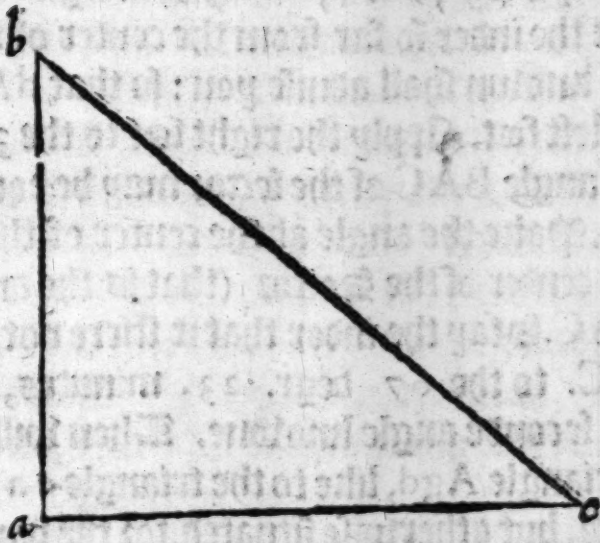
This proposition is of great vse in finding out the angles, and sides of a triangle giuen, and consequently measuring of any dimension assigned, as shall appeare in the treatise following, and therefore it is not to be neglected.

Mentioned before, pag. 1. b.



In the latter end of the 20. Proposition I said, that the use of the Geometrical angles could not well be taught; untill I had set down the propositions concerning the Index. It followeth therefore now to declare their use, which is especially to be seen in taking any height, depth, longitude, and latitude assigned. And for so much as all these dimensions are found out by proportional triangles, it shal not be amisse to declare how the sides, & angles of a triangle giue, which are unknowne, may be knowne by the Sector, and being knowne how any dimension assigned may be found out.

Let a triangle be giuen a b c. In this triangle these cases may happen that epyther 2. angles may be knowne, and one line: or one angle and 2. lines. If I know 2. angles and one line, it may fall out thus, that both y^e angles knowen may bee at the ends of the line knowne: as bac. bca: are at the ends of the line knowne a c. or els one of the angles knowne b a c. may be at a, the end of the line knowne a c. and the other angle knowne may be at the ende of a line unknowne as a b c. at b, the end of a line unknowne.



The Use of the Sector

Again if I know one angle and 2. lines, it may fall out thus: that either both the lines knowne may containe the angle which is knowne, as a b. and a c. supposed to bee knowne may containe the angle knowne b a c. Or els the one line a c. is one of the sides of the angle knowne b a c. and the other line knowne may subtend the angle knowne, as b c. subtendeth b a c. Out of these diuers cases ariseth the diuersitie of propositions following.

Proposition 24.

Two angles of a triangle being knowne, and situated at the end of a line knowne, to find the other two sides and the third angle.



Let the triangle given be e a i, whose side e i. is 21. partes, and the angle a e i. 67. d. 23. m. the angle e i a. 36. d. 52. m. being both at the endes of the line knowne e i. I desire to knowe the quantity of the angle e a i. and the 2. sides e a. and a i. First this rule is generall: The three angles of every right lined triangle are equall to 2. right angles (9. p. 6. b. of Ramus) and two right angles containe 180. degrees. Therefore if the two angles being added together be subducted out of 180. the remainder giueth the quantity of the angle vnknowne, which in this example is 75. d. 45. m. for the angle e a i. The feet are found thus: Set the index so far from the center of the sector as the partes of the line known shall aduise you: so that d A. may containe 21 partes of the left foot. Apply the right foot to the 36 d. 52 m. of the Limbe, that the angle B A C of the sector may be equal to the lesser angle known e i a. Make the angle at the center of the index equall to the angle at the center of the Sector (that is the angle f d a equall to the angle B A C. Stay the index that it stirre not, and remoue the right foote B C. to the 67 degr. 23. minutes, which is the degree of a e i. the seconde angle knowne. Then will the feet and the index make a triangle A g d, like to the triangle e a i, and proportionall in the feet, but otherwise situated, for the partes of the index g d are answerable to the side of the triangle a i, and the partes of the right foote g A. are answerable to the side of the triangle a c. So that if

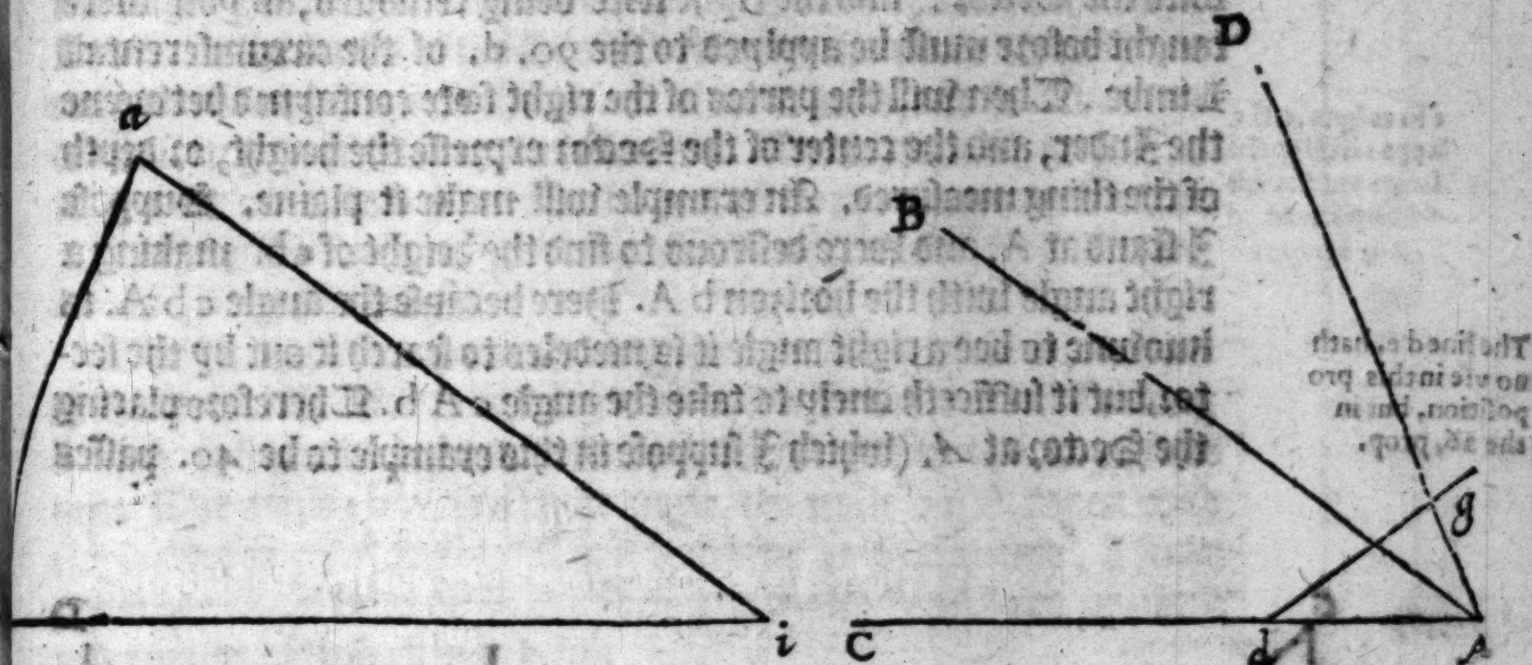
di

The vse of the Sector.

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d i the side knowne be 21. passes, the side a i. shalbe 20. and a e shall be 13. as will appeare by the sector it selfe, and is set downe in this demonstration, whose truth is proued by the 9. p. of the 7. b. of Ramus.

Mentioned before, page 92.



This proposition hath a singular vse in searching out the distance betwene two marks assigned. Suppose that betwene c. and a. there were a Riuer, and you were desirous to knowe the breadth thereof, the meanes to know it is this. On the farther side of the riuer take notice of some marke, namely of a. and on this side the riuer set by 2. marks one at c. another at i. in a known distance frō c. as 21. passes, pearches, fēete or yardes &c. Place your Sector at c. and leuelling the one foote to a. and the other to i. Search out the quantitie of the angle a c i. Likewise placing the Sector at i. take the quantitie of the angle a i c. Here two angles being known and one line, you cannot in following the former proposition, but find the quantitie of the thirde angle, and the length of the other two lines a i. and a c. which was required to be done.

Item this proposition affoordeth vs the height, and consequently the depth of any thing to be measured (for the depth is but a reuer- sed height, and the reason of searching them out is all one.) And for

¶

so

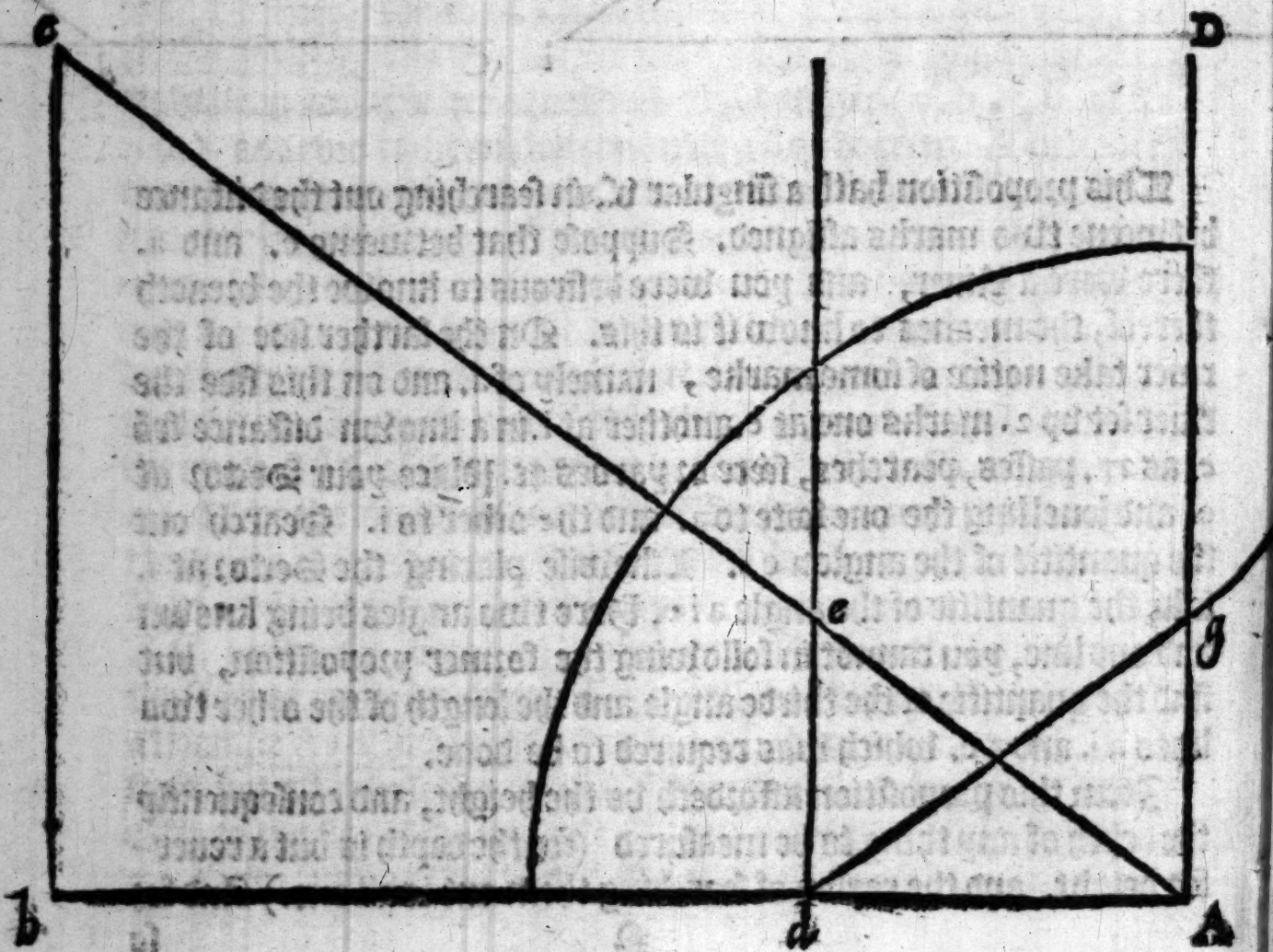
The vse of the Sector.

24

ad hanc dicitur
et eadem dicitur

so much as the height of a thing is measured by a perpendicular
draiue from the top of the thing measured, and making a right an-
gle with the base: Therefore these two dimensions are more easily
founde out then the other, wherein the triangle is most vsually an
oblique angled triangle, because it is needefull to take but one angle
with the Sector: and the right soote being remoued, as you were
taught before must be applyed to the 90. d. of the circumferentiall
Linbe. Then will the partes of the right soote contayned betwene
the Index, and the center of the Sector expresse the height, or depth
of the thing measured. An example will make it plaine. Suppose
I stand at A. and were desirous to find the height of c b. making a
right angle with the horizon b A. Here because the angle c b A. is
knowne to bee a right angle it is needeles to search it out by the sec-
tor, but it sufficeth onely to take the angle c A b. Therefore placing
the Sector at A. (which I suppose in this example to be 40. passes

The line d'e. hath
no vse in this pro-
position, but in
the 26. prop.

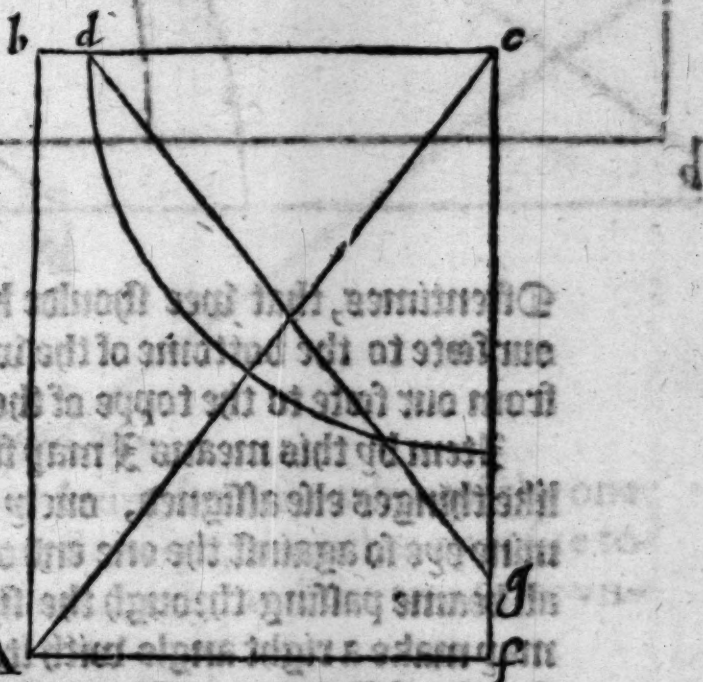


from

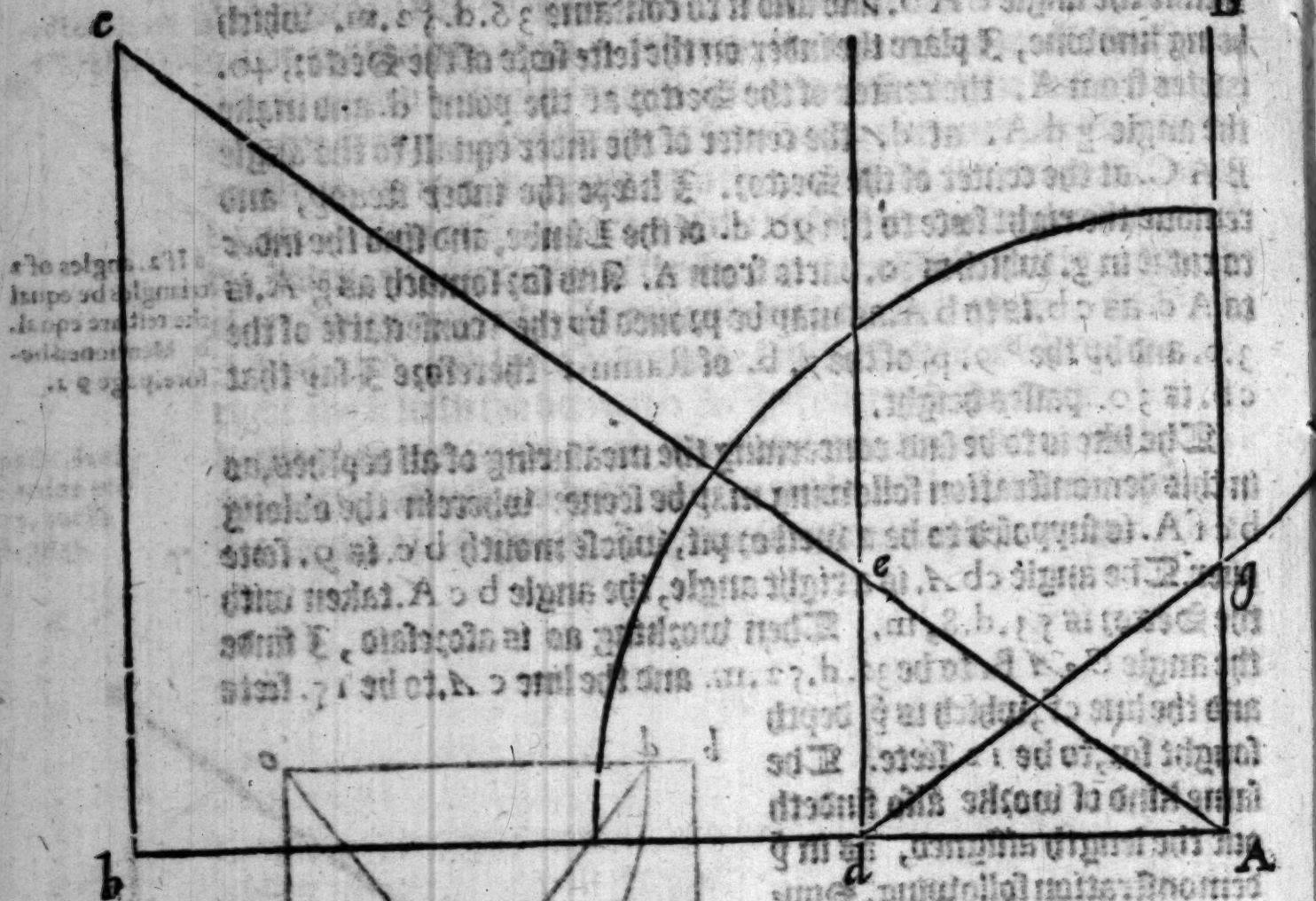
from b) so that the left foot may be parallel to the horizon, and perpendicular to the thing measured, as in this case it must alwayes be, I take the angle c A b. and find it to containe 36. d. 52. m. which being knowne, I place the index on the lefte foote of the Sector, 40. partes from A. the center of the Sector at the point d. and make the angle g d A. at d. the center of the index equall to the angle B A C. at the center of the Sector. I keepe the index steady, and remoue the right foote to the 90. d. of the Limbe, and find the index to cut it in g. which is 30. partes from A. And so much as g A. is to A d. as c b. is to b A. as may be proued by the^a consecarie of the 3. p. and by the^b 9. p. of the 7. b. of Ramus: therefore I say that c b. is 30. partes height.

a If 2. angles of 2 triangles be equal the rest are equal.
b Mentioned before, page 9. a.

The like is to be said concerning the measuring of all depths, as in this demonstration following may be seene: wherein the oblong b c f A. is supposed to be a well or pit, whose mouth b c. is 9. foote ouer. The angle c b A. is a right angle, the angle b c A. taken with the Sector is 53. d. 8. m. Then working as is aforesaid, I finde the angle C A B. to be 36. d. 52. m. and the line c A. to be 15. fete and the line c f, which is y^e depth sought for, to be 12. fete. The same kind of worke also findeth out the length assigned, as in y^e demonstration following. Suppose the length of the line A b. were to be sought out, & that I stood at the top of the tower, or other eminent place b c. whose height is knowne to bee 30. yards. The angle c b A. taken with y^e sector is 53. d. 8. m. The working as is aforesaid I find y^e angle c A B. to be 36. d. 52. m. A & the line c A. to be 50. yardes and the length b A. which is the dimension sought for, to be 40. yardes. Here you may note, that so much as the sector findeth outreadily the Hypotenusal line c A. subtending the right angle at b therefore it hath a good vse in the warlike affaires, and such likematters, wherein it is required



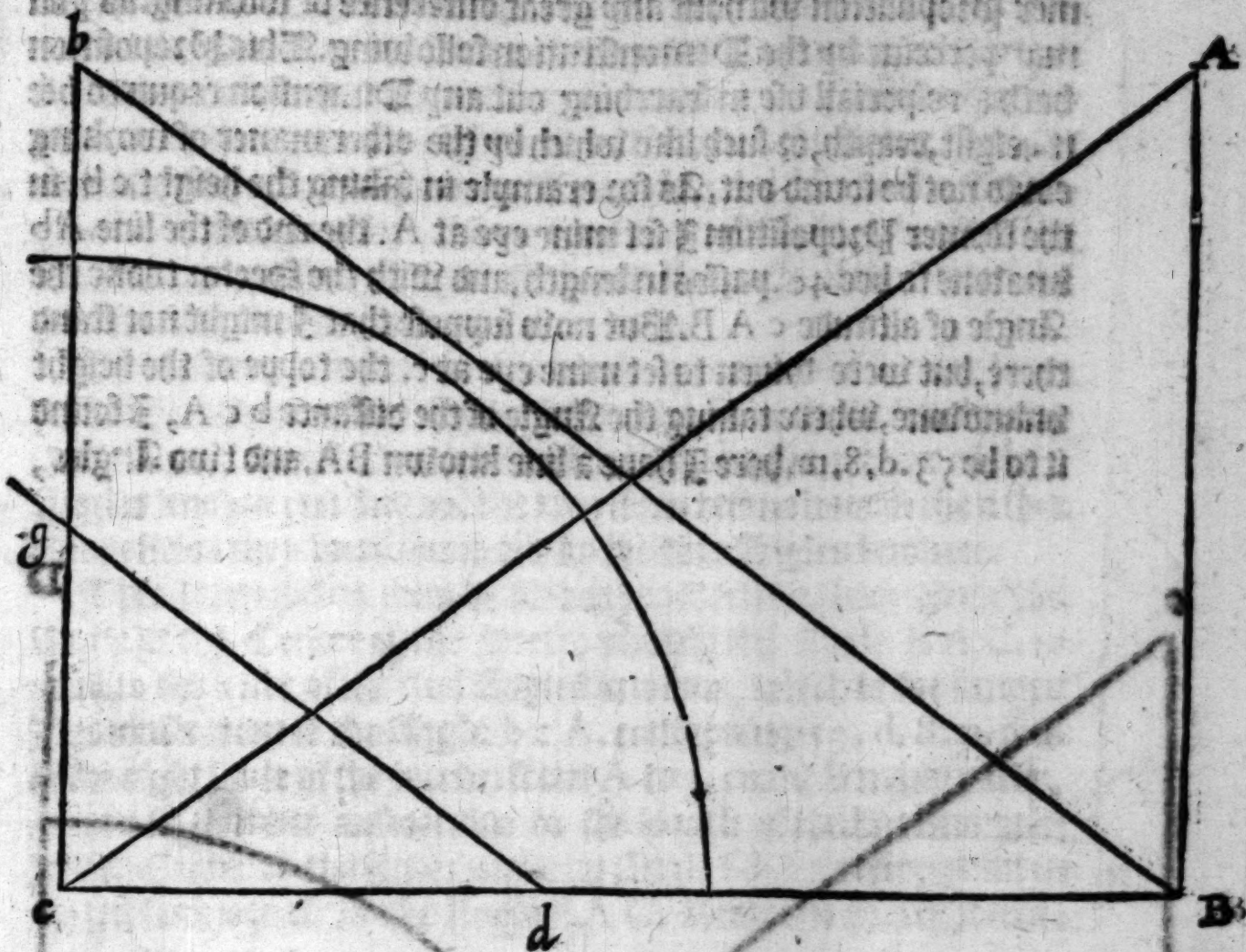
The vse of the Sector.



Oftentimes, that wee shoulde knowe not onely the distance from our foote to the bottome of the wall which is the line $A.B.$ but also from our foote to the toppe of the wall, that is the line $A.C.$

Item by this means I may find out the breadth of a wall, by such like thinges else assigned, onely by taking of one angle. If I place mine eye so against the one end of the thing measured, that the visi- all beame passing through the sightes of the lesse foote of the Sector may make a right angle with it, as may bee seene in this demon- stration following: wherein the breadth of the wall $b.A.$ is sought for; My station is made at $c.$ so, passes from $b.$ so, that the right line drawne from $c.$ to $b.$ maketh a right angle with $b.A.$ the angle $b.c.A.$ taken with the Sector is $57. d. 8. m.$ There are two angles knowne & one line. Therefore working as is aforesaid, I find \angle angle $b.A.C.$

B A c. to be 36. d. 52. m. the line **c A.** to bee 50. paces & the line **B A.** which is the breadth sought for, to be 40. paces.



Proposition. 25.

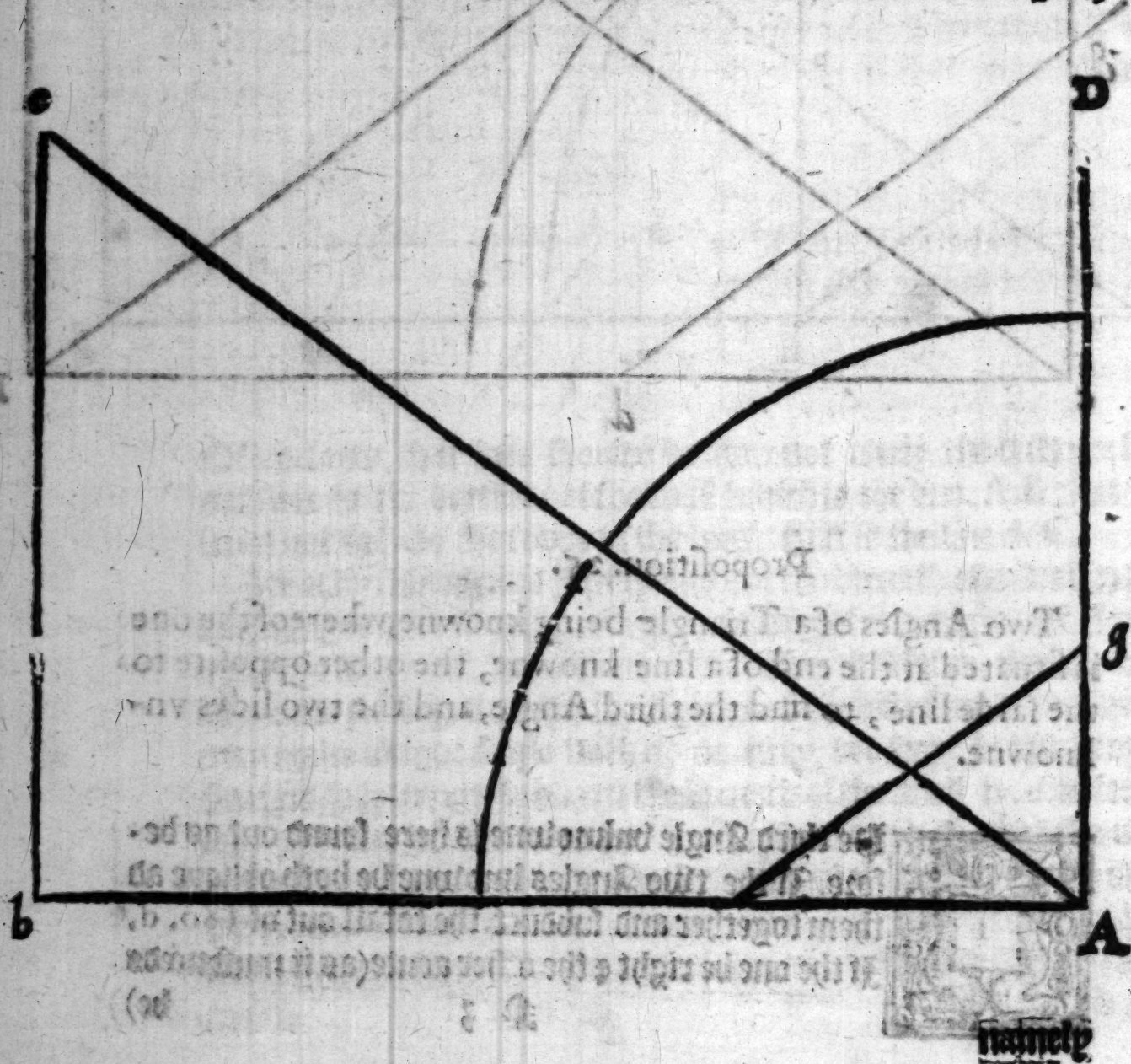
Two Angles of a Triangle being knowne, whereof the one is situated at the end of a line knowne, the other opposite to the saide line, to find the third Angle, and the two sides vnknowne.



The third Angle vnknowne is here found out as before. If the two Angles knowne be both oblique add them together and subduct the totall out of 180. d. If the one be right & the other acute (as it must needs be)

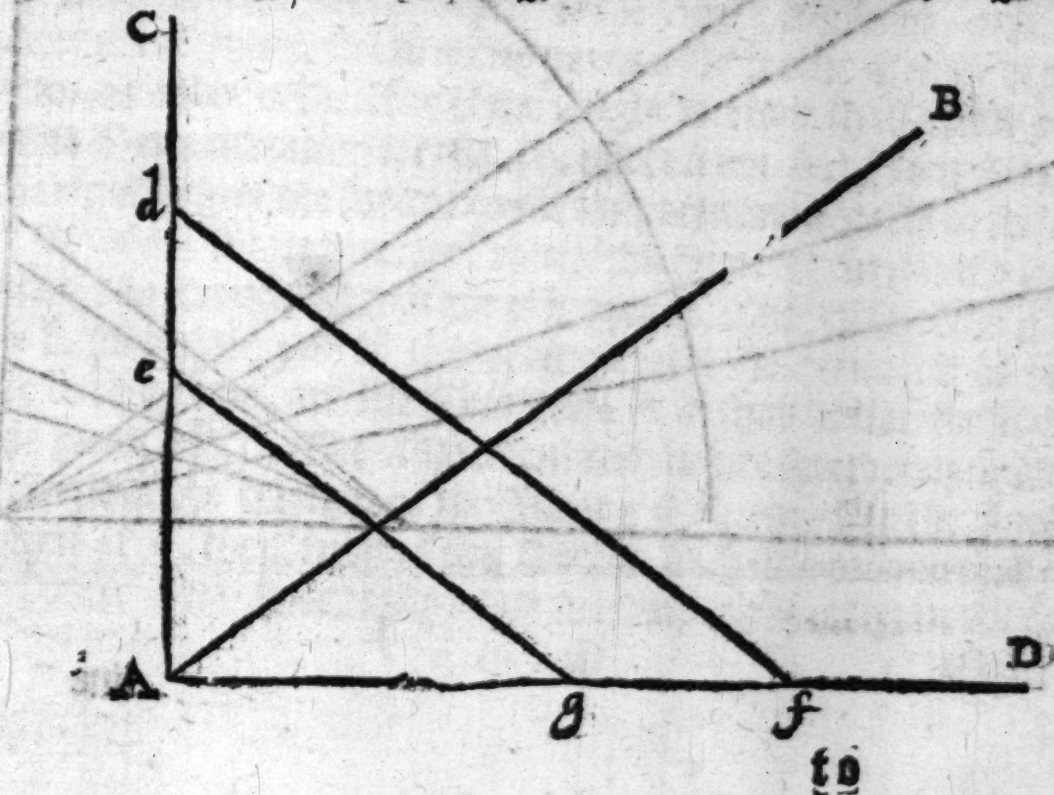
The vse of the Sector.

be) Subtract the acute Angle out of 90. d. the remainder in each subtraction giueth the Angle sought for. The two sides unknowne are found out in the same maner, as they were found out in the former Proposition without any great difference of working: as you may perceine by the Demonstration following. This Proposition hath an especiall vse in searching out any Dimension required bee it height, deapth, or such like which by the other maner of working could not be found out. As for example in taking the height cb . in the former Proposition I set mine eye at A . the end of the line Ab knowne to bee 40. paces in length, and with the Sector tooke the Angle of altitude cAB . But now suppose that I might not stand there, but were driuen to set mine eye at c . the toppe of the height unknowne, where taking the Angle of the distance bcA , I found it to be 53. d. 8. m. here I haue a line known BA . and two Angles,



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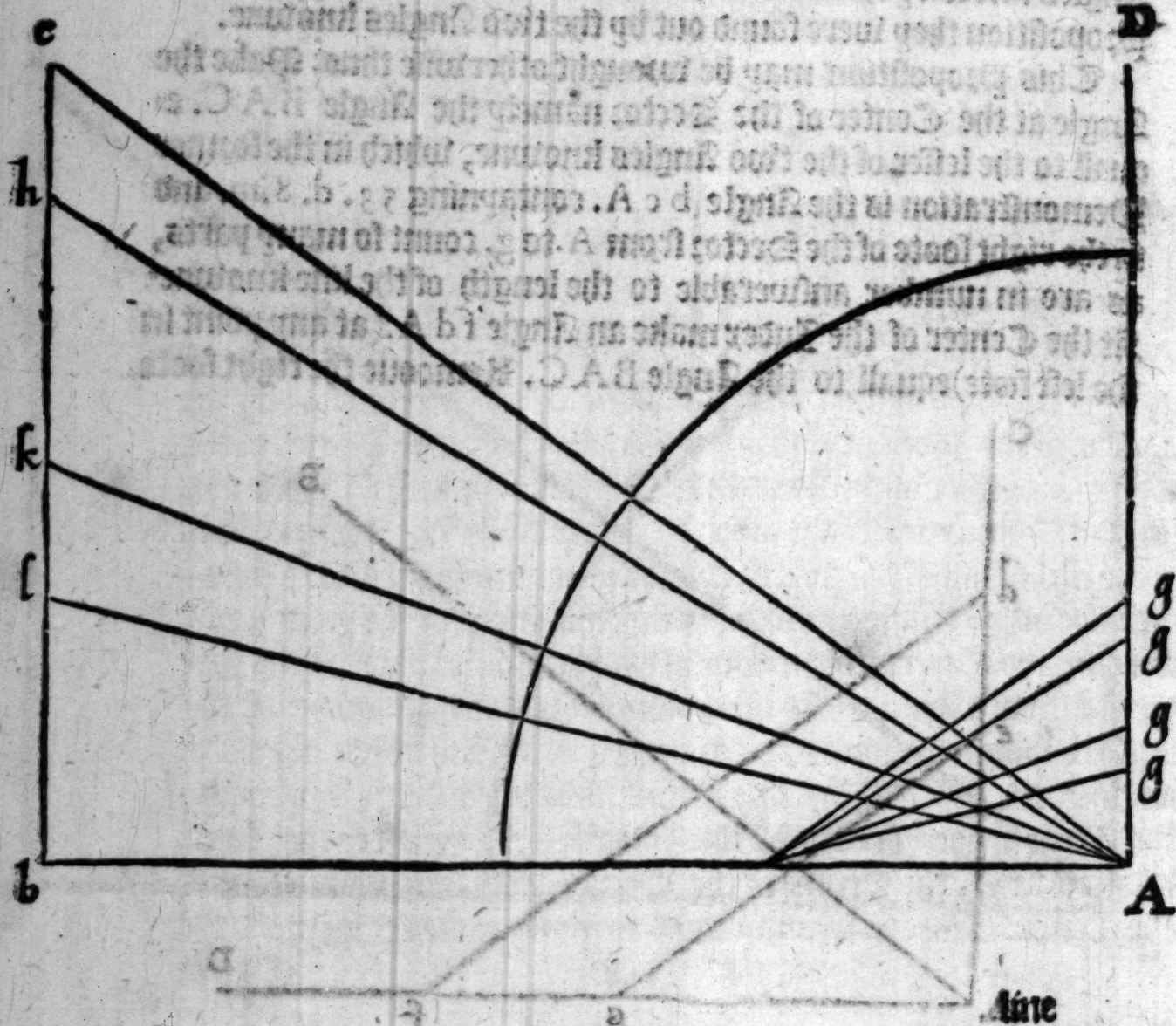
This Proposition may be wrought otherwise thus: Make the Angle at the Center of the Sector namely the Angle BAC . equall to the lesser of the two Angles knowne, which in the former Demonstration is the Angle $b c A$. containning $53. d. 8. m.$ and in the right foote of the Sector from A . to g . count so many parts, as are in number answerable to the length of the line knowne. At the Center of the Index make an Angle $f d A$. (at any point in the left foote) equall to the Angle BAC . Remoove the right foote:



The vse of the Sector.

to the degree of the greater Angle knowne. Then put the Index to and fro untill it touch the point g. The Triangle g e A. shall bee like and therefore proportionall to the Triangle A c b. so that e A shall expresse the length of the line c b. which is the height sought for as in this Demonstration going before may be seene.

As this, so are the other Dimensions to be found out, and therefore I thinke it needlesse to make any farther discourse of them. Here note, that as it is possible by the Sector to find out the whole height, deapth length or breadth of any thing measured, so it is also possible to find out any severall part of the whole Dimensions. As in this Demonstration following. The whole height c b. being knowne it is possible to know the height of b h. b k. or b l. The meanes to find them out is al one with the finding out of the whole



line $b c$. without any difference, whether you worke according to the prescript of this last, or former Proposition. Againc the length of the lines $b h$. $b k$. or $b l$. being found out it is possible to find out the length of $h c$. $k c$. or $l c$. The meanes to finde them out is by subduction of the severall parts from the whole line $b c$. As $b h$. being 25. passes taken out of $b c$. which is 30. passes, yeldeth the quantitie of $h c$. to be 5. passes, and so forth of the rest.

In this Demonstration going before, the right lines $d g$. represent the Index making severall Angles, at d . the Center of the Index equal to the severall Angles, which y^e right foote of the Sector maketh with the left foote at A . the Center of the Sector, and cutting off in $A d$. (the right foote remoued) certaine parts proportionall to the parts of the whole line $c b$.

Proposition 26.

One Angle of a Triangle, and the feet of the said Angle being knowne to find the Base, and the Angles vnknowne.

Let the Triangle giuen be $C A B$. let the Angle knowen at A . be 36. d. 52. m. let the side $b A$. be 40. & the said $A C$. be 50. passes. I desire to know the other two Angles $A b c$. and $A c b$. & the line $c b$. Set the right legge of the Sector on the degree of the Angle knowne, and the Center of the Index at d . so many parts off from the Center of the Sector, as either of the sides of the Angle knowne shall aduise you (in this Demonstration it is set 40. parts from A .) From A to c . in the right foote of the Sector count the parts answerable to the other side of the Angle knowne, moue the Index to the point c . not stirring the Center thereof out of his place. The parts of the Index $e d$. which are 30. in this example giue the quantitie of the line $c b$. sought for, and the Triangle $c A d$. shall be like the Triangle giuen $c A B$. The Angles vnknowne are found thus: make the Angle at the Center of the Index $g d A$. equall to the Angle knowne at A . the Center of the Sector, with this prouiso that d . the Center of the Index may stand so many parts off from A . the

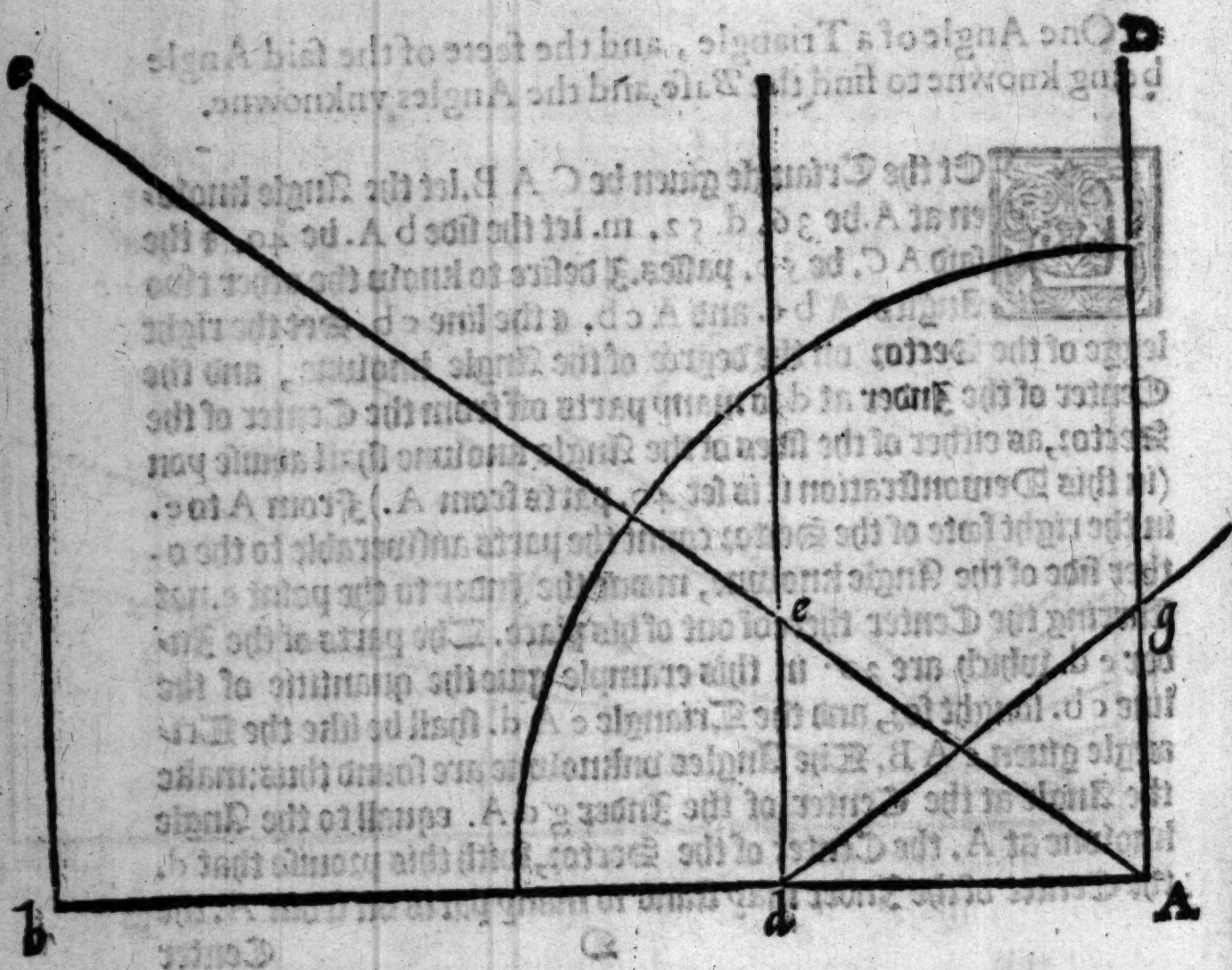
Center

Center

The vse of the Sector

Center of the Sector as it stood before: From d. to g. in the Arc
 der count so many parts as are answerable to the side of the Tri-
 angle knowne A C. which is this Demonstration are 50. remove
 the right foote to the point g. and note vpon what degree it falleth
 in that Limbe: that is the quantitie of one of the Angles unknown,
 in this Demonstration. It falleth on the 90. d. and the weth the
 quantitie of the Angles A b c. Ad those degrees to the degrees of the
 Angle knowne which is 36. degrees, 52. minutes, the totall sum
 126. degrees, 52. minutes, subducted from 180. yeldeth the
 quantitie of A c b. 53. degrees, 8. minutes the other Angle un-
 knowne, and the line g A. yeldeth the quantitie of the line c b.
 namely 30. parts as it was before. Whereby you may gather,
 that for the performance of this Proposition it is sufficient to sol-
 low this last direction concerning the finding out of the Angles,

Proposition 22



for if the Angles be once found out the séele must néedes bee proportionall as may bee proued by the 9. Proposition of the seventh booke of Ramus in this Demonstration going before. Mentioned before, pag. 9. a.

Proposition 27.

An Angle being giuen, and two lines giuen, whereof the one is the foote of the Angle giuen, and the other subtended to the said Angle, to find the quantitie of the other line, and the two Angles vnknowne.



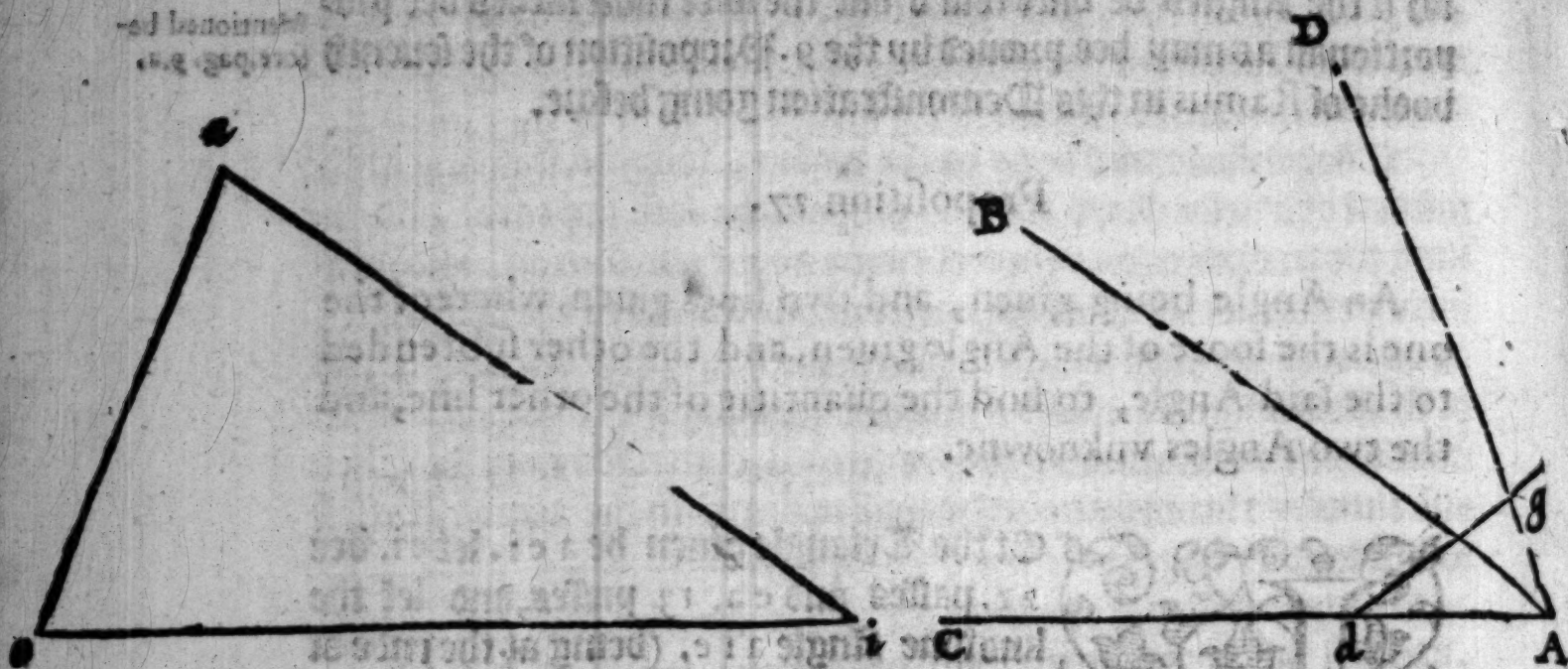
Et the Triangle giuen be a c i. let c i. bee 21. partes and c a. 13. partes, and let the knowne Angle a i c. (being at the ende of one of the lines known, and opposite to the other) containe 36. degrés 52. minutes, I desire to know the length of the line a i. and the quantitie of the Angles i c a. and c a i. vnknowne. Set the Center of the Index at the point d. 21. parts off from A. the Center of the Sector. Lay the right foote on the 36. degrés, 52. minutes of the Limbe, and make the Angle at the Center of the Index equall to the Angle at A. the Center of the Sector. In the right foote from A. to g. count 13. parts answerable to the line a c. mooue the right foote to and fro vntill the point g. lighteth vpon the edge of the Index.

The partes of the Index d g. expresse the quantitie of a i. the line sought for, which in this Demonstration are 20. Marke the degré, vpon which the right foote falleth, for that giueth one of the Angles sought for, namely the Angle i c a. which is 67. degrés 23. minutes. Adde these degrés to the degrés of the knowne Angle 36. degrés 52. minutes, the totall Summe 104. degrés 15 minutes, subducted from 180. yeldeth the quantitie of the vnknowne Angle c a i. 75. degrés 45. minutes, as may bee seene in this Demonstration, and may be proued by the ^b second and ^c ninth Proposition of the seventh booke of Ramus.

^b If two Triangles bee equall in their Angles either in two Angles containned vnder equall feet or in a paire of angles, whose side or base of both are equall their triangles are equilater. 4. & 26. p. 1.

^c Mentioned before, page 9. a.

The vse of the Sector.



If you desire to knowe why in this Proposition I counte the parts answerable to one of the lines given in the right foote of the Sector, which in the former Proposition I counted in the Index, the reason is ready, and manifest. For in this action I must haue an eye to the wordes of the Proposition. If the Proposition requireth (as the former Proposition doth) that the sides knowne should containe the Angle knowne, I must count the parts of the Sector answerable to the saide sides in the left foote of the Sector, and in the Index, because the Angle at the center of the Index is by transposition alwayes answerable to the Angle knowne. But if the Proposition requireth (as the last Proposition doth) that the one line knowne should bee the side of the Angle giuen, and that the other should bee opposite to the saide Angle, I must then count the parts answerable to the lines giuen in the left, & in the right foote, and not in the Index: Because as the left foote is alwaies one of the sides of the Angle made at the Center of the Index, so the right foote subtendeth the same Angle.

These two last Propositions do most readily deliuer vnto vs the sides of any triangulare plot of ground offered vnto vs to be measured. For whether we know one side, and two Angles, or 2. sides, and

and one angle of the figure giuen, the triangle made vpon the Sector will be like, and consequently proportionall both in the sides, and angles to the figure giuen.

They deliuer also vnto vs the reason, why by standing in the midst of a fiede (as in the 20. proposition doth appeare) and taking the seuerall angles thereof round about our station, and measuring either all the lines drawen from our station to the said angles, or one of those lines, and al the sides, we may truly describe the plat of the field assigned. Thus much concerning the taking of any dimension at one station by the Sector. A dimension may be taken also thereby at two stations, as shall appeare in the demonstration following.

Proposition 28.

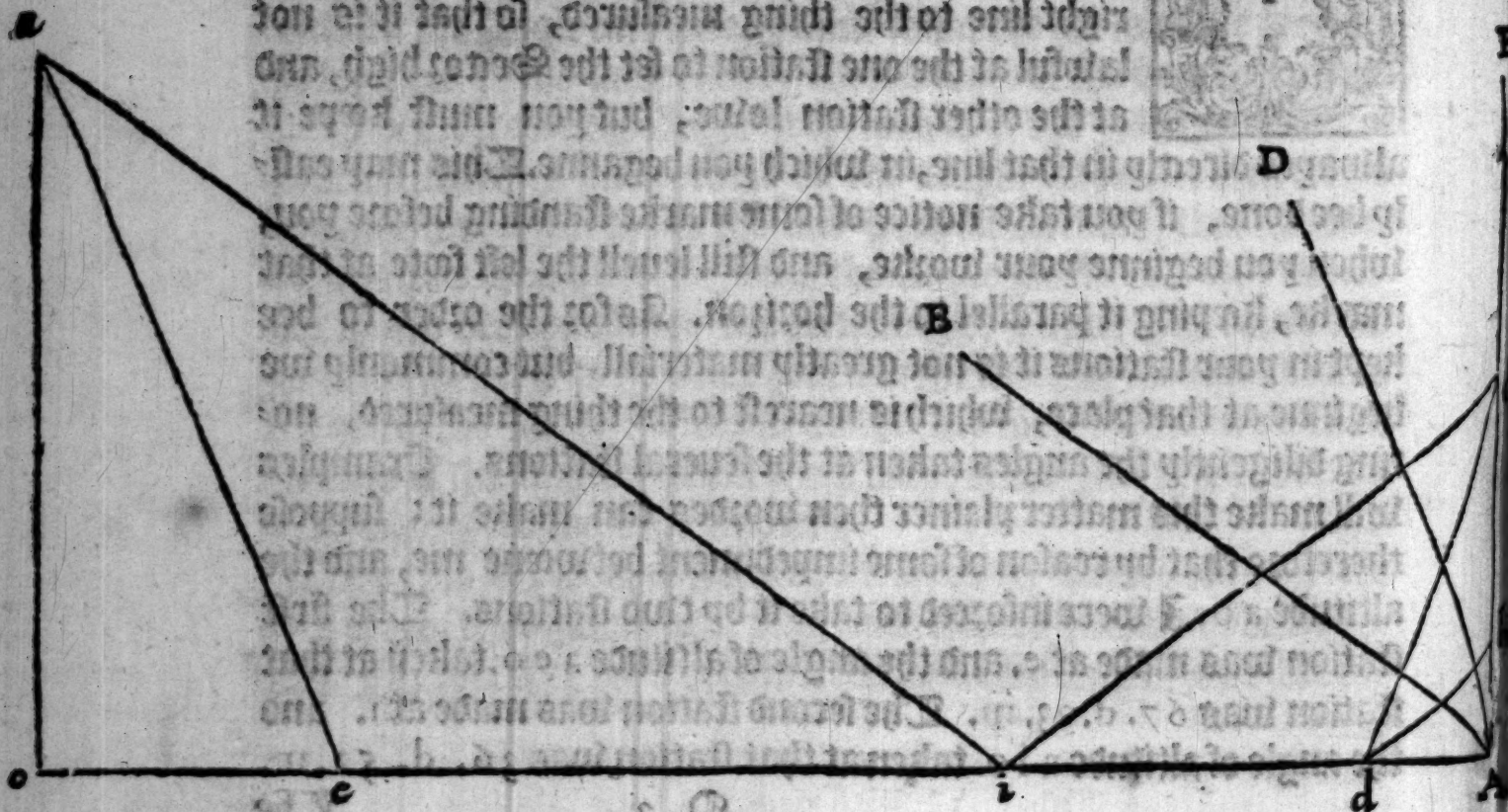
To take a dimension at 2. stations by the Sector.



In performing this conclusion this rule is generall, that the left foote of the Sector must be at each seuerall station either parallel or perpendicular in one right line to the thing measured, so that it is not lawfull at the one station to set the Sector high, and at the other station lowe, but you must keepe it alwayes directly in that line, in which you beganne. This may easily bee done, if you take notice of some marke standing before you, when you beginne your worke, and still leuell the left foote at that marke, keeping it parallel to the horizon. As for the order to bee kept in your stations it is not greatly materiall, but commonly we beginne at that place, which is nearest to the thing measured, noting diligently the angles taken at the seuerall stations. Examples will make this matter plainer then wordes can make it: suppose therefore that by reason of some impediment betwene me, and the altitude a o. I were inforced to take it by two stations. The first station was made at e. and the angle of altitude a e o. taken at that station was 67. d. 23. m. The second station was made at i. and the angle of altitude a i o. taken at that station was 36. d. 52. m.

24

right line to the thing measured, so that it is not
lateral at the one station to let the second high, and
at the other station low; but you must keep it
in that line, in which you began. This may call
you take notice of some marks standing before you,
one your look, and still keep the left foot at that
it parallel to the position. After the order to be
low it is not greatly material, but commonly the
place, which is nearly to the thing measured, and
the angles taken at the several stations. Examples
matter plain than words can make it; suppose
section of some important business, and the
be intended to take it by two stations. The first
be at, and the angle of distance is taken at that
and the second station is made to.

**generall**

rie of the third p. of the 7. b. of Ramus, and by the 9. p. of the same booke. All hereupon I inferre the proportionall termes thus, as 1. the partes of the left foote are to A g. the partes of the right foote, so is 10. the whole distance of my last station from the thing measured to a o. the height sought for. But for so much as I knowe not the whole distance of 10. (for the part of it 9. is unknown) therefore I am driven to argue from that which is knowne, namely from the distance betwene the 2. stations, and say as d. the segment of the left foote is to A g. the segment of the right foote of the Sector, so is e i. the distance betwene the 2. stations unto a o. the height sought for: but d. is 11. partes, and A g. is 12. partes of the foote of the Sector: e i. is 22. partes, therefore a o. is 24. partes high, as in the demonstration may appeare.

As the height is inferred by 2. stations, so is the breadth and length also inferred, and the maner of argument is all one from the partes knowne to the whole dimension sought for: There is no difficultie at all in finding them out, but onely this, aptly to dispose the proportionall termes, as they should be placed, and to discern which should stande in the first, which in the second, which in the thirde place, that the fourth proportionall may be truely inferred: yet is that most easie to be done, and so much the more will be, if you imprint these wordes in your minde. In all Geodeticall measurings for the most part there is one dimension given, and an other sought for: as you perceave in the last demonstration, wherein the distance betwene the 2. stations e i. was given, and the height a o. was sought for: the dimension sought for is founde by triangles. These triangles are but 2. if the dimension may be found out at one station, but if 2. stations be required, the triangles are 4. as may be seene in the 2. demonstration of the 24. proposition, and in this last demonstration. In that, the height c b was found by one station, therefore there were but 2. triangles made c A b. g d A. in this demonstr. the height a o. was found by 2. stations, therefore there were 4. triangles made a c o. a i o. g d A. g i A. Again if there be 2. triangles made, one of the is made vpon y geometrical instrument which we vse, the other is made vpo the dimension sought for, or given, as in the demonstr. first named c A b. is made vpon A b. y dimension given, or vpon c b. the dimension sought for, & the other g d A.

The vse of the Sector.

is made vpon the Sector. If there be 4. triangles made, 2. of them are made vpon the dimension sought for, or given: and the other 2. are made vpon the Geometricall instrument: as in this last demonstration $a c o$, and $a i o$. are made vpon $a o$. but $g d A$. and $g i A$. are made vpon the Sector. The triangles made vpon the instrument, and the dimension sought for, or given are alwayes equiangle, and correspondently proportional in their sides one to another, as in the triangles $a c o$. and $g d A$. the angles $a o e$. and $g A d$. Item $a c o$. and $g d A$. are equall, &c. And againe as $a o$. is to $o e$. so is $g A$. to $A d$. and alternately as $a o$. is to $g A$. so is $o e$. to $A d$. &c.

Therefore when these severall triangles are eyther expressely, or in conceit made, compare the one with the other, and note which part of the Geometricall instrument used is answerable to the dimension sought for, and which part thereof is answerable to the dimension given. That part which is answerable to the dimension given must alwayes bee the first tearme of the proportion without alteration: that part which is answerable to the dimension sought for must be the second, and the dimension given must be the third: or if you please (for these 2. latter tearmes may bee counterchanged) the dimension given may be the second, and the part answerable to the dimension sought for may be the third. As in the last demonstration $i d$. is answerable to $e i$. the distance given betwene the two stations $g A$. is answerable to $a o$. the height sought for, therefore I inferred the proportion thus, as $i d$. is to $g A$. so is $e i$. to $a o$. Or otherwise thus, the first tearme keeping still his place, as $i d$. is to $e i$. so is $g A$. to $a o$.

The like may be obserued in searching out the breadth, or length assigned as in this Demonstration following. In which the breadth $o a$. is sought for by 2. stations, and is founde by foure proportionall Triangles. Two of them $a c o$. and $a i o$. are made vpon $o a$. the Dimension sought for the other two $g d A$. and $g i A$. are made vpon the Sector. In these, the line $i d$. is answerable to $e i$. the distance given betwene the two stations and $g A$. is answerable to the Dimension sought for $a o$. Therefore I conclude the proportion thus as $i d$. is to $g A$. so is $e i$. to $a o$. Or otherwise thus, as $i d$. is to $e i$. so is $g A$. to $a o$. but $i d$. is 11. partes, and $e i$ is 22. partes, and $g A$. is 12. partes of the Sector: therefore $o a$. the breadth sought for is 24. partes.

Like

Faultes escaped.

In some booke in the first verse of the Dedicatorie Epistle Ludas is written with a capitall letter, which should be written with a small l.

Item, fol. 1 a. line 9. reade, the angle, fol. 3 line 3 reade, Octogon. line 9. for e put b. line 13 for d. put c. In the figure drawe a right line from H to O. line 18 reade, each several line. fol. 4. a. in the last marginal note reade. fol. 4, a fol. 5, a. line 7, reade, are parralels. Fol. 5. b. line 26. reade, point A, fol. 7 a. line 3 reade, vertical point fol. 10 b. line 7. reade, as 2. is to 3. fol. 19. in the demonstration at the nether side of the semicircle there wanteth the letter m, and in the diameter of the circle for m put w. fol. 20, a. in the demonstration the letters a, and e, are wanting. fol. 22, a. line 11, reade containd. In the marginal note, reade 18 a. fol. 24, the toppe of the figure is turned downward, fol. 26, a. in the figure you must draw a right line from a. to e, and an other from f, to g. fol. 29, line 9. reade BC. fol. 30, a. line 14, and 19, reade, BC, and in the ende of the last line reade of the Sector, fol. 30, b. line 1 reade, possible, line 2 reade the squares BCef, and dceh. line 4, read, BC. fol. 36, a. line 12 reade point b, line 14, reade bd. fol. 41, a. in the demonstration there wanteth the letter C, fol. 41, b line 28, reade, gd A. fol. 42 a. line 29, read, bc A, fol. 44, a. in the demonstration draw a line from b, to A. and put out the line, Bb, line 1, reade bAc, line 7, reade, bA, fol. 44, b. line 14, reade b, A. In the figure there wanteth the letter, d fol. 45, b. in the figure there wanteth the letter d, fol. 46. a. line 12 read AD, line 17 read cAb, line 19 read, side, Ac. fol. 46, b. line 5, read y limb. line 6 reade, In this demonstration it, line 7, reade, angle, fol. 47, in the margent reade, those angles.

Gentle reader I pray you excuse these faults, because I finde by experience, that it is an harder matter to print these mathematicall works trew, then bookes of other discourse: note this also that the letter a signifieth the first side of the leaf, the letter b signifieth the second side.

In some books in the first part of the Dedication Epistle I have written
 with a capital letter, which should be written with a small.
 Item, fol. 1. a line 9. reads, the angle, fol. 3. line 3. reads, Observe, line 9.
 for e put b, line 1. 3. for d, put c, in the figure draw a right line from H to O.
 line 8 reads, each of these lines, fol. 4. a in the last marginal note reads, fol.
 4. a, fol. 5. a line 7. reads, are, parallel.
 I. fol. 7. b, line 25. reads, point A, fol. 7. a line 3. reads, vertical point
 fol. 10. b, line 7. reads, as is to 3, fol. 9. in the demonstration at e, notice
 side of the semicircle there wanteth the letter m, and in the diameter of the
 circle for m put w, fol. 20. in the demonstration the letters a, and e, are
 wanting, fol. 22. a, line 11. reads, contained in the marginal note, reads, 18
 a, fol. 24. the top of the figure is turned downward, fol. 25. a, in the fi-
 gure you must draw a right line from a to c, and another from a to g, fol.
 25. line 9. reads, BC, fol. 26. a line 1. and 3. reads, BC, and in the end of
 the line reads, of the sector, fol. 30. b, line 1. reads, point B, line 2. reads
 the square BC, and deg, line 4. reads, BC, fol. 31. line 12. reads, point B,
 line 14. reads, b, fol. 41. a in the demonstration wanteth the letter C,
 fol. 41. b, line 23. reads, d, fol. 42. a line 20. reads, b, fol. 42. a in the de-
 monstration draw a line from b to A, and put on the line, B, line 1. reads
 b, A, line 7. reads, b, A, fol. 44. b, line 1. reads, b, A, in the figure draw a
 right line from b to A, in the figure there wanteth the letter d, fol. 44. a,
 line 12. reads, A, line 17. reads, A, line 18. reads, A, fol. 45. b, line 2. reads
 y, line 1. reads, in the demonstration in line 7. reads, angle, fol. 47. b,
 the marginal note, reads, angle, at e, in the demonstration in line 7. reads, angle, fol. 47. b,
 Considerer I pray you excuse these little faults, I finde
 by experience, that it is an harder matter to write these ma-
 thematicall works new, then books of other disciplines, more
 this also that the letter a, is written in the first line of the first, the
 letter b, is written in the second line.

W. J. H. H.

